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PROBLEMS IN DEVELOPMENT OF SCIENCE OF MANAGING SCIENTIFIC RESEARCH OUTLINED

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese No 6, 1981 pp 8-15

[Article by Li Chang [2621 2490], "Establishing and Developing in China the Science of Scientific Research Management"*]

[Text] In undertaking scientific management work, tasks are numerous and complicated. How can a good job of scientific management work be done? This very much merits diligent study. I believe that the most fundamental method is to make our management work more scientific, subjecting our scientific management to repeated analysis and synthesis, observation, and verification to gradually form a systematic, rational understanding that reflects the laws of scientific research management--the science of scientific research management. Below I raise several views on problems in the study and development of the science of scientific management.

I. Discussion of Problems in the Study of Scientific Research Management Methods

On the basis of the general principles of Marxism-Leninism and Mao Zedong Thought, taken together with the practical problems of our daily work, I have to understand that there are three major ways in which to study problems in scientific research management science.

1. Theory must relate to practice. This is the most fundamental method.

What is the theory of scientific research management? Our present theoretical concepts have mostly been introduced from abroad. They derive from two sources. One source is management science; the other source is metascience.

It is generally acknowledged that modern management science derives from a book written in 1911 by Taile [phonetic and possibly Tyler] titled, "Principles of Scientific Management." This book became the cornerstone of management science. Naturally, this is not to say that no management work existed before Taile, but rather that from this time onward, western management work had its own scientific theory. During World War II, owing to war needs, numerous scholars in the United Kingdom studied air defense strategy. In order to meet the challenge of German buzz bombs, in particular, scientists introduced operations science, using it to manage and deploy air defense weapons to effectively resist air

*Editor's Note: This is a portion of a report that Comrade Li Chang made on 20 August 1981 at the Chinese Academy of Science's Scientific Management Academic Discussion Meeting.

attacks on London by German V-2 guided missiles. After the war, operations science and systems science made giant strides in solving management problems in production and large research projects. Systems engineering is a new science that grew out of the use of systems science to solve engineering management and organizational implementation problems. Therefore, it is generally acknowledged that use of operations science and systems science in management work is the second stage in modern development of management science. The third stage of management science is the development in recent years of Japanese management work and management thinking. Japan emphasized the self-reliance of its people in a disadvantageous situation, attaching special importance to the work of staff and workers to combine scientific management with development of a dynamic spirit in staff and workers, linking the welfare of employees to the welfare of enterprises to attain an efficiency that is much greater than that of Europe or the United States. The "Matsushita spirit," or the "Toyota spirit" developed in Japanese enterprises are representative.

We should take a comprehensive look at modern western management science. Management science has developed out of a situation in which capitalism had entered the monopoly stage, the scale of enterprises and certain research engineering had become increasingly big and management work increasingly complex. On the one hand it has helped capitalists exploit the workers. As a result of the intensification of management, not only do the workers have to work at a hectic pace physically, but they have to work at a hectic pace mentally as well. Lenin made a brilliant exposition of this situation. On the other hand, it is scientific and it has a group of scientific theories and scientific methods, so management of all kinds of modern systems cannot do without it. For example, without this management science, American research and development of the atomic bomb, of nuclear submarines, and of the launching of the Apollo spaceship could not have succeeded. Therefore, we too should study management science. Only by relying on it can we do a good job in facing various huge and complex management tasks.

Metascience came into being in the late 1930's. Its creator was the renowned British scientist, Beierna [phonetic]. Beirna wrote many things, one of which was an important book titled, "The Social Function of Science." Publication of this book marked the birth of metascience. He also wrote two other metascience works: "Science and Society," and "Historical Science," the second of which has been published in Chinese. Following Beierna, and particularly since the 1960's, metascience has developed very rapidly abroad to become an academic field in which many noted students have appeared. Naturally western metascience also reflects the economic and social characteristics of various individual countries and carrys the imperialist stamp; consequently we should accept it only critically. For example, the west has a private ownership system and hires labor. Under a situation in which a small number of capitalists, particularly an extremely small number of monopoly capitalist blocs, controls the national pulse of the national economy and the people's livelihood, it practices free competition economically, but in fact only a small number of moneyed people fully enjoy bourgeois political and cultural democracy. The road and methods of western development of science under such social and political systems cannot all suit us. We must use them selectively.

These are the two aspects of theoretical concepts that we will introduce from abroad--management science and metascience. These are two specialized theories about which Marxism-Leninism and Mao Zedong Thought will have to give guidance, and which will have to be studied critically, taking their essence and discarding the dross for the gradual formation of our own management science and metascience and the building of our own theories.

Just what are the realities?

First, we are a large socialist country in the course of development. We have not yet industrialized, and we are relatively poor. In terms of per capita average output value, we stand beyond the hundredth position in the world. This is one aspect. The other aspect is that in terms of absolute output value, we stand among the first several positions in the world. In grain, steel, coal, and petroleum, we rank among the first 10. Therefore, our country differs very greatly from the west. Theirs is a post-industrial society. The total population in their third estate is more than the total population in the first and second estate. Western countries frequently term those who do mental work or service personnel (including hygiene, education and scientists and technicians) as "white collar," and those who do physical labor as "blue collars." We, however, are entirely different. Our physical laborers far exceed our mental laborers. This explains that our country's science and culture is still very backward. China is a large developing socialist country. This is the first reality.

Second, following the Third Plenary Session of the 11th Party Central Committee, China entered a stage dominated by socialist construction. After the socialist transformation of private ownership of the means of production was virtually complete, we still took class struggle as the key link, and this was a "leftist" error. Therefore the change that followed the Third Plenary Session possesses great strategic significance. At the same time China is now in a period of economic readjustment and restructuring, correcting the "leftist" errors in economic work that have endured for a long time, all the sectors of the national economy thereby being truly able to have planned proportional development. We are also beginning the practice of various forms of a system of economic responsibility to break the iron rice bowls and the egalitarian practice of eating out of a large common pot. Today readjustment and restructuring of agriculture has already won major breakthroughs. With the encouragement of the CCP Central Committee's correct policies, the broad masses of peasants' enthusiasm for production has had an unprecedented upsurge. Many places welcome scientists and technicians and have sent the "God of Wealth" packing to bring about a great turn of events in the several thousand year history of China's rural villages and agriculture. Readjustment and restructuring of industry will require an additional period of time. What problems does this demonstrate. This shows that in our building of the four modernization, we must rely first on policies and second on science and technology. We have to use modern science and technology for the technological reform of agriculture and industry to assure fulfillment of China's economic construction tasks. This is the second reality.

Third, China possesses a certain economic and scientific and technical foundation. Specialized scientific research organizations throughout the country today employ 33,000 research personnel, which is no small force. This is an

important circumstance. However, as to how we should employ this force to do a good job in our scientific endeavors is a matter about which we have no mature experiences and about which we have not formed our own models for development of science. The level of our management science undertakings is still very low, and large numbers of problems await our solution. Practice since the founding of the People's Republic and Central Committee documents have designated the Chinese Academy of Sciences as China's supreme academic organization and the overall research center for the natural sciences. Its research tasks include responsibility for basic science, technological science, and management science. We already possess a foundation for the first two of these, but research in management science has just begun. The purpose of this conference is to give impetus to research work of this nature. How to manage such a huge academic organization is a problem urgently awaiting research. In terms of the Chinese Academy of Sciences as a whole, not long ago, we made a major restructuring of the leadership organization, convened a conference of committee members in various fields, elected a body of chairmen, and from among the body of chairmen elected a director and deputy director of the academy, established five fields of learning and a management metascience unit, and firmed up academic leadership. Now that the main academy has been restructured, what to do about the institutes is a large problem that we must study and solve.

The three points given above are our current realities that are fairly closely related to scientific research. Theory must be linked to practice, meaning that it is necessary to use knowledge from the management science and metascience sphere to zero in on China's national scientific research work and problems to find management methods that are effective for us. Our point in emphasizing this is that we must be extremely careful in our use of foreign things. Circumstances in China differ greatly from those in foreign countries. Without clearheaded analysis, indiscriminate copying can often lead to losses. In the past we sustained losses as a result of indiscriminate copying of the methods of the USSR. Today we have to be sure not to suffer losses from indiscriminate copying of the methods of Europe, the United States, and Japan. We can only apply advanced foreign scientific theories in combination with practice in China, studying both overall macroscopic problems and studying the microscopic problems in each individual institute and unit, seeking in a combination of theory and practice ways to develop and effectively manage China's scientific endeavors. This is the first probelm in methodology.

2. Going from perceptual knowledge to rational knowledge, from the specific to the general, and from the general to the specific is another important method to which we should adhere. As applied to this academic conference, a difference exists between our explicit work report and academic report. It is sufficient for a work report to explain clearly specific circumstances and how problems were solved, but an academic report has to elevate to rational cognition, a knowledge of laws, or a knowledge of innate character. For example, in doing modern research, the Academy of Sciences has dealt with the problem of whether the Dongting Lake region should grow double crops of rice or a single crop of rice, and the problem of low yields per unit of area and inconsistent total output in Heilongjiang Province. These are external phenomena, but what is the innate character? Previous research slowly found some rational understanding. The innate character of growing crops is nothing more than a unified matter of biological factors and environmental factors. Grain crops are living things

that have their own laws of growth. The role of people has just two aspects: Use of its laws so that it fits the environmental factors, and change in environmental factors so they fit the laws of growth of crops, thereby unifying them to obtain more agricultural products for human use. Therefore, crops have to be compatible with soil, climate and such environmental factors, and this is a fundamental problem in agriculture. In perceiving the problem in this way, it is possible to see that some places in Taoyuan County in Hunan Province have an insufficiently long growing season for two crops of rice; consequently the late rice crop will not get sufficient sunlight, and energy and carbon dioxide will not be completely transformed into the organic matter of rice through photosynthesis; thus outputs will be very low. Therefore, double crops of rice will not work in some places in this province. To try to grow double crops of rice breaks the unity of biological factors and environmental factors, and wastes effort. The situation in northern Heilongjiang is as follows. First very little fertilizer is applied, so yields per unit of area are low. Secondly, the frost-free period there is short. It has been possible to grow wheat and soybeans there because wheat and soybeans are harvested early, and are suited to the climate there. Subsequently, in an effort to get high yields per unit of area from corn, much corn was planted and problems readily developed. Corn ripens fairly late. If the frost season arrives a few days early, yields will drop tremendously. Sometimes when the frost arrives just 1 day early, the whole province sustains losses of 100 million jin of grain creating inconsistency in total output.

In studying scientific research management problems, we should also use this method. We cannot simply study and solve them on the basis of problems in a single unit or a single institute. We must seek a general problem in the special problems of each institute, bringing it to an understanding of operative laws. In this way not only can the problems of these institutes be solved, but the problems of other institutes may be solved as well. To put it more simply, this method is simply to regard specific things as the rudiments, and then proceed to toss aside some specific phenomena to seek knowledge of the innate character, i.e. to elevate the particular to the general to bring forth some general concepts and cause these concepts not only to apply to a single unit but also to apply to other units. Once we have mastered these methods, we will have avoided the error of considering things as they stand, and give research work academic standards.

3. Summarization and creation from abundant practical experiences of scientific research the management theories that suit China's circumstances.

We comrades who study scientific research management problems have a common characteristic, namely that as a result of long work in scientific research management, we possess abundant practical experience. Our job is to summarize this abundant practical experience and create out of it our own theories. It was said in the foregoing that our present theories have been imported from abroad, and we must analyze, study, and master them; however, simple dependence on these theories is not enough. We must also have something that is our own. No matter how good someone else's things may be, they do not necessarily fit our circumstances. Only when those theories that have been demonstrated to be correct are linked to our own practice can we gradually summarize and create scientific research management theories that fit China's circumstances. This

is what Premier Zhou taught in the past, raising understanding to a high rationale from a foundation of wideranging practice.

The ordering of experiences in practice to form rational knowledge and knowledge that fits a pattern has another advantage, and that is it is easy to examine practices, and it is also easy to get reactions from all quarters. Inasmuch as other people have also encountered the situations you have experienced and the problems you have encountered, whether or not the laws you have distilled can solve the situations they have gone through or can solve the problems they are now facing will soon be reported back to you. In this way you can do further study and make additional summaries to improve the conclusions you have arrived at. Therefore, we should treasure our advantages, and pay attention to the voice of experience, making efforts to distill experience from practice and to introduce and study theories from abroad in combination with them. This should become our extremely important method of study.

I have spoken above about three methods of study. Naturally, these are only the most important ones, and the ones that are generally applicable for study. When we have a clear view of the basic methods, we will have a common foundation for the study of scientific research management, and we will be able the better to let a hundred schools of thought contend and hasten the building of our research management branch of learning.

II. Problems in the Relationship Among Scientific Research Management Science, Management Science, and Metascience

We have held two national metascience discussion meetings. The field of study of metascience is a fairly large one, and the way in which various countries refer to it are not entirely the same. There is also a difference in emphasis on what is studied. On the basis of China's circumstances, which branch of it should we study? Comrades involved in metascience have already discussed some views, and have proposed organization of forces for a cooperative division of labor in studying several branches of this field of study. The first is theoretical metascience, which consists principally of the laws of development of research science, the laws of technical development, and other theoretical problems. The second is called scientific economics, which consists mostly of the study of the effects of economics on science and the effects of science on economics. This problem is a very important one, and we have numerous problems that are not clear. For example, when foreign countries use concrete economic benefits to express the value of scientific research creations, we are not just sure about how this is calculated. The third is termed the study of scientific policies. The fourth is termed the study of scientific talent.

In addition to these four branches, I believe we have yet another important branch of science requiring study, namely the scientific management field of learning. What would be a good name for this discipline? Some comrades have suggested adding the word "study" making it the study of scientific research management. In foreign countries, however, the term management includes the meaning of dealing, so it might also be termed the study of scientific dealing. Naturally, if this term is to be used, scientists will disagree inasmuch as dealing has something of a commercial air about it, which scientists might feel

is too vulgar. To term it the study of scientific management also has some drawbacks. In Chinese, the term management conveys a sense of administration. Some scientists point out that you want less ministration and more rationality. Consideration might therefore be given to calling it the study of scientific research organization inasmuch as management work is, in fact, organizational work, and is really no more than the organization of all forces, and the organization of various research topics and individual research tasks. Everyone can present his own views to help find a better term.

Well then, what is the relationship among the study of scientific research management or the study of scientific dealing, or the study of scientific research organization to management science and metascience? Can we understand that it is both an integral part of management science and also an integral part of metascience? The study of scientific research management is a research management problem; therefore, it is a part of management science. However, the management problems it studies are not the usual management problems, but rather management problems in scientific research activities. This belongs to the category of metascience research and becomes a branch discipline in metascience. Its theoretical foundation has already been mentioned. It draws from management science and metascience. It uses the knowledge and concepts of management science and the knowledge and concepts of metascience. When the knowledge and concepts of these two fields are applied to the study of scientific research management problems, they form the study of scientific research management. In this sense, the study of scientific research management is an applied science, which applies management science and metascience theories to scientific research management tasks. Therefore, we comrades who are engaged in scientific research management studies cannot depart from the study of and research into management science and metascience. We must take nourishment to strengthen ourselves from these sciences, the more thoroughgoingly to study problems in scientific research management.

III. The Make-up of the Study of Scientific Research Management Science

Well then, just what problems are studies in scientific research management science? I shall now present seven by way of demonstration.

1. Study of Problems in the Scientific Research System

Problems in the scientific research system were raised earliest by Comrade Xiaoping in 1977. At that time, Comrade Xiaoping asked Comrade Fang Yi and me to provide a scientific research system for the reorganization of the scientific research system to make it one that fitted circumstances in China.

Problems in the system were very numerous. For example, the scientific research system in China consists of five major parts: the national defense industry system, the production industrial sector system, regional systems, institution of higher learning system, and the Chinese Academy of Sciences system. These five large systems are under the unified political direction of the Central Committee, and their policies are coordinated by the National Science Commission. However, much of their day to day activities are very loosely organized and not sufficiently intercoordinated, and this is a problem in the system.

As another example, how to coordinate the central and regional systems, the Academy of Science system and the system of each department in the central government, the military research system and the civil scientific research system is also a major system's probelm. In addition, in view of the regional distribution of research organizations and the subordinate relationships of each institute, figuring out which institute is superior and which institute is subordinate in a period of readjustment and restructuring is related to systems problems and requires study.

The Chinese Academy of Sciences also is facing problems pertaining to its organization. Prior to the "Cultural Revolution," the Chinese Academy of Sciences had 106 institutes. By the close of the "Cultural Revolution" only somewhat more than 40 remained, most of them individually organized. Now a number have returned, or have been newly founded, bringing research organizations to 118. Views on this matter are not entirely similar. Some think there is no need to have brought so many back, while others believe that inasmuch as many disciplines and many branches of service characterize the Academy of Sciences, the return of this number has been fundamentally correct. Just what is the case? What is to be done in the future? This is a systems problem we face.

Last year we worked together with the National Energy Commission in a joint operation, mostly with the energy office of the original Natural Resources Overall Examination Association, to run an energy research institute. The duties, expenses, and staffing of the research were defined and solved by the National Energy Commission, and we were responsible for the ideological and political work, and for the academic work. As a result, this institute developed well, solving the problem of linkage between the Academy of Sciences and units outside the academy. This method of running an institute is also a problem in scientific research systems. In short, the problems in scientific research systems faced by China and the Academy of Sciences are numerous, and they should be a major ingredient in research management science research.

2. Study of Research Organizations and Their Organizational Problems

Research institutions have problems in the foundation for and timing of their establishment, development, division into institutes, division into units, and disbandment, their location and requirements. These problems are very complex. Instances in which organizational problems are fairly prominent now, and particularly when organization of institutes urgently require solution, should be major ingredients for scientific research management science study.

Research institutes differ from the usual grassroots units. They are at once both a grassroots unit and a cell in society, and are an academic institution the personnel of which may have attained the highest levels or may be the supreme authorities in the country in a particular discipline or academic field. This determines that institutes should have a little more organizational authority. Unless they do, the abilities of these scientists may be limited in their full play.

Policy organizations for institutes are also a problem. In the operation of people's democratic dictatorship in China, the national and local national

people's congresses exercise state authority. Reflecting this spirit, the academic organization that is the Academy of Sciences designated the Plenary Conference of Committee Members in All Academic Fields the policy organization of the entire academy. How are the institutes run? There are three ideas now. One is that political and economic decisions and decisions on matters pertaining to worker and employee welfare should be decided by an employees and workers conference, and academic decisions should be the precinct of an academic commission. The problem with this idea lies in having two decision making organizations in existence in institutes at the same time. Another idea is that since institutes do mostly academic work, therefore a conference of researchers above the rank of assistant researcher in each institute should be the policy making organization. This idea also poses problems. The work of an institute touches on overall party, government, trade union, and youth league matters. Without authority to make decisions on these matters, how can they function? The third idea is to have research personnel above the rank of assistant researcher elect an academic committee on which also sit representatives of the party, the government, the trade union, and the youth league to form an institute affairs conference, or an institute affairs committee, invested with decision making authority.

The party leadership system in institutes also has two views now. One proposal is a continuation of the system of institute director responsibility under leadership of the CCP Committee. One suggestion is trial operation of an institute director system, the CCP Committee playing a supervisory and guaranteeing role. The Central Committee has indicated that the institute director system under leadership of CCP committees is not to be further changed, and some pilot projects for the institute director system may be run. This is to say that this problem still requires our study and our practice. Naturally, the urgent question of the moment is proper separation between party and government and strengthening of ideological and political work. The organizational problems are, in fact, problems of a system of responsibility. Under a situation in which the programs for operating the academy are well defined, and under which the planning personnel, materials and operating expenses, as well as political and ideological work are substantially normal and under the guidance of the correct line and policies of the CCP Central Committee, the quality of an institute's work will be determined by whether or not it is able to perfect a democratic organization and a party leadership organization throughout the institute. This is to say that in addition to taking responsibility for its own leadership, the academy must also place responsibility for doing a good job in institutes on institute affairs committees, on directors of institutes, and on the masses of staff and workers, and on CCP committees and all members of the party and the youth league. Without a system of responsibility, there can be no efficiency.

3. Study of Problems in the Structure of Research Units

Structural problems include equitable proportioning of personnel in all parts of the total organization, how each part coordinates its activities, how completion of key tasks is assured in each unit, and how to lay different stress on the work of a system at different times so as to increase research work efficiency, etc. As far as the Academy of Sciences is concerned, problems

exist mainly in two areas. One is problems internal to perfecting the system; the other is the problem of buttressing liaison between upper and lower echelons.

Within the institutes of the Chinese Academy of Sciences are five systems. 1. The research system including theoretical research and practical research. 2. Research method system, which includes experimental equipment, information, library, printing, and production systems. 3. Research management system. 4. Logistics work system. 5. Ideological and political work system. Research work is the center piece, and all projects are indispensable. However, ideological and political work is a prerequisite and fundamental guarantee for the existence of our socialist research organizations. Today it must be vigorously strengthened. Finally logistical work, particularly whether housing is built in a planned and step by step way and is fairly allocated, is also a crucial problem affecting whether or not institutes in the academy can develop.

Echelon problems are yet another structural problem urgently requiring study. Too many echelons are no good. When echelons are numerous, blockages occur in their mid sections, and leaders in the upper echelons can easily become separated from the lower echelons. Too few echelons do not work either. The upper echelons directly manage lower echelons too much, and this may result in organizational looseness and inflexible guidance. Echelons in the Academy of Sciences today include the academy, branch academies, institutes, offices, and topical units. How to enhance liaison between upper and lower echelons very much merits study.

4. Study of the Problem of Research Planning

Research plans must center on difficult problems. This is a fundamental principle. Only when there are problems, people, funds, and materials can work go on. The problem here is how are problems set.

Ximeng [phonetic], who received a Nobel prize in economics in 1978, provided "three principles" that organizations must follow."

First, large units should have alrge objectives, and small units should have small objectives. Small objectives should be subordinate to large objectives. Put in the context of the realities of China's Academy of Sciences, all characteristics, programs, and tasks in the Academy of Sciences must be brought to bear on the problems. Problems cannot be divorced from this goal. This is a fundamental principle.

Second, each of the subordinate units should enjoy relative independence. To use his words, if the amount of information from outside that is transmitted in a unit is larger than the amount of information transmitted from within, this shows that the unit cannot function without the help of outside units, and the unit has lost its capability to exist. Conversely, only when a unit possess independent work capability can it continue to exist.

Third, the work process requires specialization. Only with specialization is it possible to have high efficiency.

I feel there is a lot of sense in what Ximeng said. Our selection of problems should also follow this principle. Our academy is a large system in which all institutes and all offices are sub-systems. The professional orientation of the entire academy should be manifested through the problems on which each individual institute is working. The goals of individual institutes should be synonymous with the overall goals of the academy as a whole. If they are not, the overall tasks of the academy as a whole will be destroyed. Today our general program and general task is "emphasis on both sides, and two services." The meaning of "emphasis on both sides" is that we are required to become the country's supreme academic institution, and the problems we work on should be representative of national standards. If our institutes work on all problems, doing a little bit but doing it on all subjects, it will inevitably be impossible to attain advanced standards, and the character of our academy will be changed. We should select those topics that have theoretical significance and practical value. For problems in the theoretical field, in particular, it is necessary to work on projects that possess their own distinguishing features and are creative in nature. This requires study of our principles for the selection of topics and our methods of evaluating topics so as to assure a seeking after major fields and major orientation.

Problems raised by "two services" are also numerous. During the period immediately following Liberation, our academy of sciences rendered a contribution in the elimination of locusts and plague. During the 1960's and 1970's, we also made great contributions in service to national defense projects. What projects are we wrestling with now? On the basis of national requirements and insofar as strength permits, we have made up our minds to do more work in the modernization of agriculture, in energy, and in building materials. How to select additional tasks and topics requires further study.

One further point. In doing research planning, it is necessary to consider manpower, funds and materials together. Without consideration of manpower, funds, and materials, the plans you work out will not be realizable. Little consideration was given to this aspect in the past. As a result, some projects encountered difficulties and could not be continued. However, exactly how to proceed is also a problem that research management science should study.

5. Study of the Problem of Research Ranks

Ranks is a military term borrowed for use here. Work involving ranks means the job of formulating organization and coordination of personnel. How large an organization does an institute need? What kinds of personnel does it need? What differences are there in personnel structure of different institutes? These are all problems having to do with the research ranks. We are weakest in this regard, having no ideas at all. Formerly when someone mentioned establishment of an institute, that meant people. Large institutes up to a thousand; medium size institutes 500 or 600; small institutes 200 or 300. As to the kinds of people needed, how many of each, and what kinds are lacking were never stated clearly. Research work today requires diverse specialists working together in order to move it ahead; therefore, selection of staff has to be done scientifically and equitably if it is to be effective.

Additionally is the problem of plans for training people. For every institute, how many of each kind of personnel should be trained, how many of these should be sent abroad and how many will be trained by ourselves, and how many will be sent to other units all require planning. Training is for the purpose of meeting needs. It is for the purpose of improving, after a period of time, a unit's research level and capability to make a greater contribution to the country. Without such explicit objectives, training work is doomed to failure from its inception.

The problem of verification of research cadres and research management cadres should become a major problem on which study is currently focused. There appear to be two points requiring separation. The first point is verification of effectiveness of cadre work. We have to look at their accomplishments and not look only at their academic record or professional levels. Academic records and professional levels only signify their capabilities for achievement; they are not the same as what they have done. Distinctions among achievements are of no less than four kinds. The first is excelling, achievements being very outstanding. The second is ability to handle any job. The third is inability to handle any job. The fourth is of no use whatsoever. Through such an overall examination, we will have some ideas about the promotion and deployment of cadres. For example, outstanding cadres may be entrusted to do the more important jobs. Those in the last two categories should be transferred to other work. The second point is that in analyzing current cadre shortcomings to find what training or other efforts should be made, it is necessary to begin with analysis of his basic qualifications and not look only at his achievements. Comrades in the Changchun Precision Optical Machine Institute presented a mathematical model for analyzing research management cadre qualifications, which is very interesting and can help us find areas in which we, ourselves, are deficient, thereby determining the orientation of our own efforts. I believe our political work cadres might also use this method to reveal their own inadequacies. The essence of this analysis is to stress that all categories of cadres should gradually become specialized and knowledgeable. This orientation is synonymous with the spirit of instructions from the Central Committee on the need for cadres to be made revolutionary, young, specialized, an knowledgeable.

6. Study of Academic Exchanges Inside and Outside the Country

Academic exchanges hold an important position in research work. Without academic exchange, research organizations become ponds of stagnant water. How can academic exchanges be done, and what forms of academic exchange are both effective and handy? These are problems that require solution in research management work.

Academic exchange methods are numerous. I would like to emphasize two points. The first point is the issue of research centers. Research centers are a most important modern form of exchange. For example, the research centers of France and Germany are characterized by having not many research personnel from this kind of research organization itself; less than half. Most are from elsewhere or students from abroad, or else research fellows. Those who go there mostly do research for a fixed period of time. Since they come from everywhere, think-

ing in all academic fields done there is very lively. Can we also do the same thing? We have some institutes in which research forces and laboratories are rather good. The problem now is mostly one of lack of buildings. We should make some trials little by little during the next several years.

The second point is the problem of visiting scholars. During the past several years, we have sent out very many visiting scholars, many of whom have already returned to China. They went to friendly foreign scientists to accept invitations to participate in research work or to exchange academic ideas from which both parties gained. But this was done in different ways. Some went to do work as research fellows (to study for degrees or not to study for degrees); some scholars able to work independently carried out joint research; some with specialities went to teach or make academic reports; and still others, who were internationally famous scholars, did work that was in the nature of academic guidance. All of this work should be summarized well so that our work in sending people abroad will become more effective.

7. Study of the Problem of Scientific Forecasting

In doing scientific management work, we must give constant attention to and chart the future orientation of our development. Study of scientific forecasting is the foundation for setting future orientation and development. For example, in what direction should our academy of sciences develop? In what direction should our institutes develop? These questions can be answered only on a foundation of what new situations may arise as determined by forecasting research.

The aforementioned seven points do not constitute the entire content of scientific research management science. They are only the relatively important aspects in it. As to what other ingredients for study should be included in scientific management science, everyone can discuss, and they can consider whether all major problems encountered in scientific research management should become objects for its study.

9432
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'RENMIN RIBAO' ON SCIENTIFIC RESEARCH FREEDOM

HK051414 Beijing RENMIN RIBAO in Chinese 26 Feb 82 p 5

[Article by Gong Yushi [7895 5148 0037]: "Observe the Party's Resolutions and Safeguard the Freedom of Scientific Research"]

[Text] Can the party's resolutions draw conclusions on theoretical issues? This question cannot be raised in general terms, and we cannot say in general whether they can or cannot. Many theoretical issues need not and should not use the form of party resolutions to draw conclusions. However, on fundamental questions of theory involving the party's guiding ideology, the party must draw its own conclusions. Because a party like ours is not formed spontaneously. It is not merely a party formed for the sake of a certain specific action. Ours is a party guided and organized by a definite theory. The existence of the proletariat and its militant practice, when reflected in the theoretical thinking of science, become Marxism. Marxist theory combined with the workers' movements of various countries have given rise to revolutionary proletarian parties in various countries guided by Marxist theory and organized for concerted action. This use of a kind of scientific theory as the guiding ideology to determine our own objectives of struggle and to fix our own line and policies is a basic quality of our party. Therefore, on such fundamental questions of theory involving the theoretical basis of the guiding ideology of the party, the objectives of struggle and the party program and the theoretical basis of the line and policies of the party, the party not only can but also must, on the basis of full scientific study and by means of solemn democratic process, form resolutions, draw conclusions and determine its own common viewpoint and stand in order to unify the understanding of the whole party and observe them together. Only thus can the party become a disciplined and organized militant contingent guided by a common theory and take concerted action.

Then, why is there still uncertainty? This is because our party has made serious political and theoretical mistakes in the past. These mistakes were adopted in past resolutions and confirmed as "correct" by the party. Because of the authority and binding force of party resolutions, a demand was made on the theoretical circles to publicize and "expound and prove" these mistakes. Now, in summing up the events of the past, the comrades of the theoretical circles are constantly talking about this kind of historical lessons. We must indeed profoundly bear in mind this kind of historical lesson. However, we cannot simply draw the conclusion here that the party must not determine its own standpoint on such questions of theory or write it into its resolutions in

the future. We also cannot say that future theoretical work and party resolutions must not have any connection. We should make a concrete analysis of past experiences and lessons. We should say, the trouble is not in the resolutions made by the party on questions of theory or that the theoretical work of the party must comply with the party's resolutions. The trouble is in the political and theoretical mistakes in some of the resolutions made by our party in the past. Therefore, the key lies with the accuracy of major decisions made by our party in the political and theoretical field. If mistakes appear, we must make every effort to correct them more promptly and successfully. For this reason, I think we must:

1. Make every effort to place the decisions of our party in the political and theoretical field on the basis of scientific research. In other words, we must first use scientific research work to correctly formulate the resolutions of the party. All important resolutions of the party should be based on the scientific research of actual conditions and practical experiences and should be examined in practice to determine whether they are right or wrong. This is the primary demand.

2. Strictly observe democratic centralism, and develop the party's resolutions on a democratic basis. Different views must be fully discussed in a free and democratic manner. We not only must submit to the view of the majority, but we must also respect the view of the minority. We cannot suppress different views.

3. Continue to adopt a scientific and democratic attitude in implementing a resolution after it has been passed. We must correctly handle the relations between observing the resolution and exchanging views freely on questions of theory in accordance with the spirit of seeking truth from facts and the principle of democratic centralism. A resolution of the party reflects the common understanding of the party, this militant collective, in a certain period. This understanding, which is obtained from scientific research and from a democratic exchange of views, is considered by everyone as correct, and must be jointly observed and implemented by the whole party. Whether or not this understanding, which has a binding force on members of the collective, is correct or not must still be examined in practice. The free exchange of views within the procedure stipulated by democratic centralism is still allowed.

Therefore, a resolution itself should be not only a product of scientific research, but it at the same time is also the object of continued scientific research. Since it is a collective product based on democracy, it must at the same time give play to democracy in the process of implementation. A resolution of the party is not final. It is not an absolute thing that cannot tolerate research or discussion. When implementing and publicizing a resolution of the party, we must maintain a scientific and democratic attitude. We must see how we can continue to prove and examine it in actual life in connection with reality and continue to put forth new problems to push it forward and develop it. This is the endless process of practice and knowledge in repeated cycles.

At the same time, we must also see that the conclusion drawn by a resolution of the party on questions of theory should be limited to questions of a fundamental nature concerning the guiding ideology of the party, which the whole party must obtain common understanding of, in order to observe and take con-

certed action. However, we need not and should not let a resolution of the party draw conclusions on questions that do not belong to this nature or questions of a more academic nature. Even questions of theory which require the whole party to obta'n common understanding of and which must be determined by a resolution of the party are also limited to their fundamental understanding and fundamental attitude. Those questions in the theoretical and academic field, which require more meticulous examination, also need not be determined by a resolution of the party. Regarding such questions, under the premise of unity in fundamental viewpoint and fundamental attitude, the development of meticulous examination may completely take the form of a free exchange of views.

The use of this kind of scientific and democratic attitude in formulating and handling party resolutions can unify the observation of party resolutions and the scientific research and scientific discussion on questions of theory. The basis of unity is the scientific attitude of seeking truth from facts or the organizational system of democratic centralism. Party resolutions have a binding force on party members and the theoretical workers of the party. Practice is the criterion for determining the truthfulness of our understanding. There is only this criterion, and there is no other. We cannot rely on democratic centralism, the majority, the upper level or resolutions to determine the truthfulness of our understanding. We can only rely on the examination of practice. This is a question of the theory of knowledge. For the sake of understanding objective truth, we must have freedom of scientific research and freedom of scientific discussion based on practice. Without this kind of freedom, the path to understanding truth will be blocked and the cause of the revolution will also suffer. These are questions of two different categories, but they are also closely related. We must try and unify them, and we can unify them. For our party is one which seeks truth and submits to truth, and as in the lyrics of "internationale," a party which "struggles for truth." If the democratic centralism of our party can be conscientiously observed and practiced, it can guarantee that our party becomes the mainstay of our understanding about the collective and enable us to understand truth. Even if mistakes were to appear, we would also be able to successfully correct them. The unity obtained on the basis of the scientific attitude of seeking truth from facts and the organizational system of democratic centralism is the unity of the Marxist theory on party building and the theory of knowledge. It is the unity of communists submitting to organization and submitting to the truth.

For the sake of correctly carrying out scientific discussion and scientific criticism on questions of theory, we must exert great efforts to eliminate the pernicious influence of the unscientific method of "mass criticism" which was prevalent for a long time in the past. For more than a decade after the latter part of the 1950's, the repeated criticism of the wrong line in the party basically confused right and wrong on many occasions. The confusing of right and wrong could only have been caused by the unscientific methods adopted by political criticism and theoretical criticism. This kind of criticism did not proceed form reality but determined a target of criticism beforehand and criticized it from all sides. There was no room for carrying out scientific research. In gathering materials for criticism, we did not objectively, comprehensively or historically study what these materials actually reflected but examined them with a strong prejudice to find what could be pieced together for

use against the target. We deliberately misinterpreted things, mixed up quotations, homed in on a single point without considering other aspects, extended the meaning of statements at will, raised minor issues to the level of principle, paid no attention to history and made no analyses. In the past, this metaphysical method of negating everything by "mass criticism" was quite serious in our political life and in our theoretical work and had a very deep influence on us. We must consciously strive to overcome this influence and break away from these old habits. Old habits are difficult to change, but we must change them. On questions of theory, regardless of whether criticizing erroneous things or discussing different views, we must adhere to the scientific attitude of seeking truth from facts. We would adhere to the scientific attitude of seeking truth from facts. We would not use the unscientific method of criticism even against our enemies, so how could we use it within our own ranks! Therefore, within our ranks and among our comrades, the discussion and criticism of views we consider to be wrong or inappropriate are permissible. This kind of criticism should be carried out with a solemn, scientific and realistic attitude. We must adopt the attitude of respecting objective reality, respecting historical facts, making analyses and allowing discussion. We must not adopt a frivolous, temperamental and unscientific attitude. Only in this way can we make advance in the scientific field.

There is also a question of the line of demarcation between open discussion and internal discussion. The "guiding principles for inner-party political life" stipulates: "If there are dissenting views on matters concerning the fundamental interests of the party and state, or major political questions of theory and policy that affect the overall situation, they can be discussed on appropriate occasions within the party. But when and how these should be discussed in the newspapers and magazines should be decided by the Central Committee. The party's journals should unconditionally publicize the party's line, principles, policies and political views. As for major political questions of theory and policy already decided by the Central Committee, if a party member has a dissenting view, he can raise it through the given organizational procedure, but he is absolutely not allowed to openly issue any statement opposing the decision of the Central Committee in newspapers or radio broadcasts. He is also not allowed to spread any view opposing the party's line, policies, principles and decisions among the masses. This is the discipline of the party." This stipulation is definitely not intended to stop our free research and discussion of party resolutions. It requires us to prudently handle this question in accordance with the discipline and principles of the party, the interests of the party and people and the demands of the struggle situation and to carry out scientific research and scientific discussion in the correct form and procedure.

In conclusion, I think that in these two aspects of observing the party's discipline and decisions and carrying out free scientific study and scientific discussion on questions of theory, it is entirely possible to achieve unity on the basis of the scientific attitude of seeking truth from facts and the organizational system of democratic centralism. As a militant organization, the party must have unified understanding, unified discipline and unified action. At the same time, as an organization of advanced elements of the Proletariat guided by the science of Marxism, it is necessary to establish its ideology and policies on a scientific basis in order to maintain the correctness of its guiding ideology. It is necessary to develop free scientific research and scientific discussion in order to achieve scientific understanding. These two aspects must be unified and can certainly be unified.

CSO: 4008/118

ADVANCES IN RADAR, TRACKING SYSTEMS DETAILED

Tracking System With Regenerative Feedback

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 6, 1981 pp 1-12

[Article by Wang Zuoying [3679 0155 5391] of Qinghua University: "Analysis of the Regenerative Feedback Tracking System"; This article received in October 1980 and finalized in March 1981]

[Text] Abstract

The regenerative feedback tracking system in an effective system for precise tracking of large dynamic targets. Because it is a multiple input and multiple output nonlinear system, in the past, we could only carry out quantitative studies[1,2] using the computer to solve the nonlinear dynamic equations of the system and obtain their numerical solution. This article uses the time domain operator to establish a mathematical model for the system and obtains the analytic expression for computing the precision of tracking by the system. Analysis shows that the error in tracking a target in powered flight by the system and the random error become an analytic and computational problem of the steady linear system in rectangular coordinates, and the mismatching error of tracking by the system is an analytic and computational problem of the steady linear system in spherical coordinates. Therefore, the results obtained are very suitable for engineering calculations and design.

I. Foreword

The spatial coordinates of a target of a radar telemetric system is a system in spherical coordinates. Therefore, it is natural for a classical radar tracking system to filter the waves of the signals in spherical coordinates. But because spherical coordinates are an inertia coordinates system, the expression of the spherical coordinates of the orbit of motion of the target frequently has a very wide frequency band, and this sharpens the conflict between the capability of the tracking system to respond rapidly to the motion of a target and the ability to suppress random interference.

Thus, frequently, the classical tracking system cannot adequately handle the requirements of highly precise tracking and tracking within a wide dynamic range demanded by modern aviation and space technology. The regenerative feedback tracking system is an effective system to solve the conflict described above.

The time domain operator method proposed in this article establishes a precise mathematical model for the system and obtains corresponding analytic expressions. The method of the time domain operator itself is an algebraic method, and the results obtained can be understood within the context of the concepts of the method of classical frequency domains, therefore it is very suitable for engineering calculations.

II. Model of the System

The block diagram of the regenerative feedback tracking system is illustrated in Figure 1.

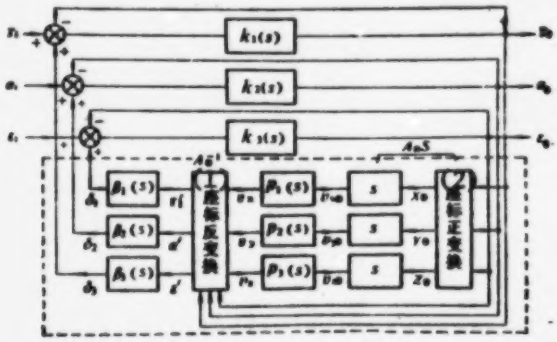

Figure 1. Block diagram of a regenerative feedtack tracking system

Key: (1) Inverse transformation of coordinates
(2) Normal transformation of coordinates

The difference between this system and the classical tracking system is that a regenerative feedback channel (or called computer-aided tracking channel)(1) as shown in the block of dotted lines in Figure 1 has been added. This channel transforms the telemetric values r_0, α_0, θ_0 of the target measured by the system in spherical coordinates into velocities v_{xo}, v_{yo}, v_{zo} in rectangular coordinates, and it smoothes the filtered waves in the wave filter with $P_1(s)$, $P_2(s)$, $P_3(s)$ as its three transfer functions. After being smoothed, the velocities v_x, v_y, v_z in rectangular coordinates are transformed into corresponding velocities in spherical coordinates r', α', ε' by inverse transformation of the rectangular coordinates v_x, v_y, v_z to obtain appropriate regenerative feedback control values. Finally, through a signal forming network with transfer functions $\beta_1(s)$, $\beta_2(s)$, $\beta_3(s)$, the required regenerative feedback signals δ_r, δ_α, δ_ε are obtained and sent to the corresponding master channels, thus completing the entire regenerative feedback process.

Besides the two transformations of coordinates in the regenerative feedback tracking system, the remaining domains are all steady linear domains of population parameters. Their signal transformation function can be described by transfer functions of the classical frequency method. But because of the introduction of a nonlinear transformation of coordinates into the closed domain system, the entire system becomes a highly nonlinear multiple input and multiple output system. Because the classical frequency method is ineffective for this kind of nonlinear systems, therefore, quantitative analysis of the system in the time domain must be carried out. The following starts out from the regenerative feedback channel, establishes a mathematical model of the system in the time domain and explains the essentials of the time domain operator method.

First, the output signal $\Psi_0 \triangleq [\gamma_0 \alpha_0 \beta_0]^T$ is transformed into velocities in rectangular coordinates $X_0 \triangleq [x_0 y_0 z_0]^T$:

$$V_0 = [v_{x0} v_{y0} v_{z0}]^T \tag{1}$$

where all quantities in the equation are time functions, and for convenience, time (t) is omitted. Because

$$x_0 = r_0 \cos \varepsilon_0 \cos \alpha_0, \quad y_0 = r_0 \cos \varepsilon_0 \sin \alpha_0, \quad z_0 = r_0 \sin \varepsilon_0 \tag{2}$$

thus,

$$V_0 \triangleq dX_0/dt = A_0 \Psi_0' \tag{3}$$

where Ψ_0' represents the time derivative of Ψ_0, i.e., the velocity vector in spherical coordinates. A_0 is the normal transformation matrix of the coordinates:

$$A_0 = \begin{bmatrix} \cos \varepsilon_0 \cos \alpha_0 & -r_0 \cos \varepsilon_0 \sin \alpha_0 & -r_0 \sin \varepsilon_0 \cos \alpha_0 \\ \cos \varepsilon_0 \sin \alpha_0 & r_0 \cos \varepsilon_0 \cos \alpha_0 & -r_0 \sin \varepsilon_0 \sin \alpha_0 \\ \sin \varepsilon_0 & 0 & r_0 \cos \varepsilon_0 \end{bmatrix} \tag{4}$$

Because A_0 contains the output quantities r_0, α_0, ε_0 of the system, therefore the system is nonlinear.

Second, the smoothing of the velocity signals by the transfer functions $p_i(s)$ ($i = 1, 2, 3$) of the wave filter is regarded as a type of linear computation of input signals in the time domain, and the relationship between input and output is:

$$V = P(s)V_0 \tag{5}$$

where V_0, V are respectively the velocities in rectangular coordinates before and after the smoothed filter wave. They are all time functions. $P(s)$ is understood as a linear operator

$$P(s) \triangleq \begin{bmatrix} p_1(s) & 0 & 0 \\ 0 & p_2(s) & 0 \\ 0 & 0 & p_3(s) \end{bmatrix} \tag{6}$$

in the time domain. We know from Laplace transform that when p(s) is a time domain operator, its variable s is a differential operator s = d/dt, and p(s) is regarded as a function of the differential operator s.

Inverse transformation of coordinates transforms the velocity V in rectangular coordinates into a corresponding velocity Ψ' in spherical coordinates. The relationship between them obeys equation (3). Therefore,

$$\Psi' = A_0^{-1}V \tag{7}$$

where A_0^{-1} is the inverse matrix of A_0:

$$A_0^{-1} = \begin{bmatrix} \cos\varepsilon_0\cos\alpha_0 & \cos\varepsilon_0\sin\alpha_0 & \sin\varepsilon_0 \\ -\sin\alpha_0/r_0\cos\varepsilon_0 & \cos\alpha_0/r_0\cos\varepsilon_0 & 0 \\ -\sin\varepsilon_0\cos\alpha_0/r_0 & -\sin\varepsilon_0\sin\alpha_0/r_0 & \cos\varepsilon_0/r_0 \end{bmatrix} \tag{8}$$

The feedback forming domain is also a wave filter with a transfer function $\beta_i(s)$ (i=1, 2, 3). Let

$$\delta \triangleq \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \end{bmatrix}, \quad B(s) \triangleq \begin{bmatrix} \beta_1(s) & 0 & 0 \\ 0 & \beta_2(s) & 0 \\ 0 & 0 & \beta_3(s) \end{bmatrix} \tag{9}$$

B(s) is also a time domain operator. Its effect on the input and the signal Ψ' can be written as

$$\delta = B(s)\ \Psi' \tag{10}$$

Substituting equations (3), (5) and (7) one after the other, and utilizing the relation $\Psi' = s\Psi_0$, equation (10) can be written as

$$\delta = B(s)A_0^{-1}P(s)A_0 s\Psi_0 \tag{11}$$

Equation (11) is the transformation of the signal by the regenerative feedback channel. In the equation, A_0 , A_0^{-1} are time functions while B(s), P(s) are functions of the differential operator s. It is worth pointing out that the order of multiplication of each operator in the equation cannot be changed at will. The condition in which the order of multiplication of the operators can be changed will be discussed later.

Now, let us establish the mathematical model for the whole closed domain system. According to equation(11), the transformation of signals by the

regenerative feedback channel is equivalent to the time domain operator defined by the following equation:

$$T(s,t) \triangleq B(s)A_0^{-1}P(s)A_0 s \tag{12}$$

Let

$$K(s)=\begin{bmatrix} k_1(s) & 0 & 0 \\ 0 & k_2(s) & 0 \\ 0 & 0 & k_3(s) \end{bmatrix} \tag{13}$$

Then the equivalent block diagram of the system is shown in Figure 2. Thus, we have:

$$\begin{aligned} \Psi_0 &= K(s)[\Psi_i - \Psi_0 + \delta] \\ &= K(s,\Psi_i)\Psi_i - K(s)\Psi_0 + K(s)B(s)A_0^{-1}P(s)A_0 s\Psi_0 \end{aligned} \tag{14}$$

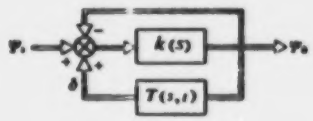

Figure 2. Block diagram of the vector structure of the system

After a simple algegraic transformation, we obtain:

$$\begin{aligned} &[E+K(s)-K(s)B(s)s]\Psi_0 \\ &= K(s)\Psi_i - K(s)B(s)A_0^{-1}[E-P(s)]A_0 s\Psi_0 \end{aligned} \tag{15}$$

where Ψ_i represents the input vectors of the system in spherical coordinates, E is the constant operator (i.e., 3X3 unit matrix).

Equation (15) is the mathematical model that describes the work of the whole regenerative feedback tracking system. Because A_0 and A_0^{-1} include the output r_0, α_0, ε_0 of the system, equation (15) is a nonlinear operator equation. The quantitative analysis of performance of the system becomes a solution of that nonlinear operator equation.

III. Precision of Tracking by the System

In the following, we will solve equation (15) to find the analytic expression for calculating the precision of tracking by the system. Let the real values of the coordinates of the target be:

$$\Psi_T = [r_T,\ \alpha_T,\ \varepsilon_T]^T \tag{16}$$

The random interference of the input signal is:

$$N_i = [n_r, n_\alpha, n_\varepsilon]^T \tag{17}$$

Then $$\Psi_i = \Psi_T + N_i \tag{18}$$

Assume that the tracking error is:

$$\Delta\Psi = [\Delta r, \Delta\alpha, \Delta\varepsilon]^T \tag{19}$$

then $$\Psi_0 = \Psi_T + \Delta\Psi \tag{20}$$

In the second term on the right side of equation (15)

$$A_0 s\Psi_0 = V_0 = sX_0 = s(X_T + \Delta X) = V_T + s\Delta X \tag{21}$$

where X_T, ΔX are the values corresponding to Ψ_T, $\Delta\Psi$ in rectangular coordinates, and $V_T = sX_T$ is the expression of the velocity of the target in rectangular coordinates.

$$\Delta X = (\partial X_T/\partial r)\Delta r + (\partial X_T/\partial\alpha)\Delta\alpha + (\partial X_T/\partial\varepsilon)\Delta\varepsilon = A_T\Delta\Psi \tag{22}$$

We can use the right side of the expression of the above equation as a substitute for ΔX because after the system enters tracking status, Δr, $\Delta\alpha$, $\Delta\varepsilon$ are all very small, and the high order infinitessimal quantities can be ignored. A_T is the transformation matrix of the coordinates obtained after substituting the output r_0, α_0, ε_0 in matrix A_0 by the corresponding coordinates r_T, α_T, ε_T. Substituting equation (22) into equation (21), we have:

$$A_0 s\Psi_0 = A_T s\Psi_T + sA_T\Delta\Psi \tag{23}$$

Here, we have used the relation $V_T = A_T s\Psi_T$

After substituting equations (18), (20) and (23) into equation (15) and rearranging the terms, we have

$$\begin{aligned}[E + K(s) - K(s)B(s)s]\Delta\Psi = {} & [K(s)B(s) - E]\Psi_T + K(s)N_i \\ & - K(s)B(s)A_0^{-1}[E - P(s)] \cdot [A_T s\Psi_T + sA_T\Delta\Psi]\end{aligned} \tag{24}$$

Because the design of the system will always make the distortion of the velocity signals $V_T = A_T s\Psi_T$ by P(s) very small, and $sA_T\Delta\Psi$ itself is also a very small quantity, therefore the signal following the operator A_0^{-1} in the above equation is a first order infinitessimal quantity. Expanding A_0^{-1} at Ψ_T and taking the first order approximation, we have:

$$A_0^{-1} \triangleq A^{-1}(\Psi_T + \Delta\Psi) = A^{-1}(\Psi_T) + \Delta A^{-1} = A_T^{-1} + \Delta A^{-1}$$

$$\Delta A^{-1} = \frac{\partial A_T^{-1}}{\partial r}\Delta r + \frac{\partial A_T^{-1}}{\partial a}\Delta a + \frac{\partial A_T^{-1}}{\partial \varepsilon}\Delta \varepsilon$$

ΔA^{-1} is also a first order infinitessimal quantity, therefore its effect in equation (24) can be neglected, thus, equation (24) becomes:

$$\begin{aligned}[E+K(s)-K(s)B(s)s]\Delta\Psi &= [K(s)B(s)s-E]\Psi_T \\ &+K(s)B(s)A_T^{-1}[P(s)-E]A_T s\Psi_T + K(s)N_i \\ &+K(s)B(s)A_T^{-1}[P(s)-E]sA_T\Delta\Psi\end{aligned} \tag{25}$$

All the operators K(s), B(s), P(s) in the s functions in equation (25) are diagonal matrices. According to our understanding of the time domain of these operators, the computational relationship between them is a commutative algebraic system. Therefore, if we multiply both sides of equation (25) by the inverse operator of the left side of the equation, we have:

$$\begin{aligned}\Delta\Psi = &\frac{K(s)B(s)s-E}{E+K(s)-K(s)B(s)s}\Psi_T + \frac{K(s)B(s)}{E+K(s)-K(s)B(s)s} \\ &\cdot A_T^{-1}[P(s)-E]A_T s\Psi_T \\ &+\frac{K(s)}{E+K(s)-K(s)B(s)s}N_i - \frac{K(s)B(s)}{E+K(s)-K(s)B(s)s} \\ &\cdot A_T^{-1}[E-P(s)]sA_T\Delta\Psi\end{aligned} \tag{26}$$

Let $$W(s) \triangleq \frac{K(s)}{E+K(s)-K(s)B(s)s} \triangleq \begin{bmatrix} W_1(s) & 0 & 0 \\ 0 & W_2(s) & 0 \\ 0 & 0 & W_3(s) \end{bmatrix} \tag{27}$$

Then $$\begin{aligned}&\{E+W(s)B(s)A_T^{-1}[E-P(s)]sA_T\}\Delta\Psi \\ &=[W(s)-E]\Psi_T + W(s)B(s)A_T^{-1}[P(s)-E]A_T s\Psi_T + W(s)N_i\end{aligned} \tag{28}$$

This is the operator equation satisfied by the tracking error $\Delta\Psi$. Because A_T and A_T^{-1} are all functions of the target coordinates Ψ_T only, they are unrelated to the output Ψ_0. Therefore, it is a time variant linear operator equation. Calculations of the tracking error $\Delta\Psi$ becomes a problem of solving this operator equation. Before discussing the general solution of this operator equation, let us first discuss the solution of the tracking velocity of a symmetrically structured regenerative feedback tracking system. In this system, the operators are designed to be

$$\begin{aligned}k_1(s) = k_2(s) = k_3(s) = k_0/s \\ \beta_1(s) = \beta_2(s) = \beta_3(s) = 1/k_0\end{aligned} \tag{29}$$

Substituting the above equation into equation (27), we have W(s) = E, thus equation (28) becomes

$$\left\{E+A_T^{-1}\frac{1}{k_0}\left[E-P(s)\right]sA_T\right\}\Delta\Psi=A_T^{-1}\frac{1}{k_0}\left[E-P(s)\right]A_TsV_T+N_i \tag{30}$$

The inverse of the left operator of the equation

$$\left\{E+A_T^{-1}\frac{1}{k_0}\left[E-P(s)\right]sA_T\right\}^{-1}=A_T^{-1}\frac{k_0E}{k_0E+[E-P(s)]s}A_T \tag{31}$$

Thus

$$\Delta\Psi=A_T^{-1}\frac{E-P(s)}{k_0E+[E-P(s)]s}A_TsV_T+A_T^{-1}\frac{k_0E}{k_0E+[E-P(s)]s}A_TN_i \tag{32}$$

Equation (32) is an analytic expression of the tracking error of the system. According to equation (32), when the vectors Ψ_T of the coordinates of motion of the target and the randomly interfering noise N_i of the input of the system are given, we can obtain the tracking error $\Delta\Psi$ of the regenerative feedback system in tracking the velocity of the target. The first term on the right side of the equation is the lagging error of tracking created by the powered flight of the target, the second term is the random error of tracking.

If we multiply the two sides of equation (32) simultaneously on the left by A_T, and if we take into consideration $\Delta X = A_T\Delta\Psi$, $V_T = A_TsV_T = sX_T$ and $\Delta X_i = A_TN_i$, then

$$\Delta X=\frac{[E-P(s)]s}{k_0E+[E-P(s)]s}X_T+\frac{k_0E}{k_0E+[E-P(s)]s}\Delta X_i \tag{33}$$

This is a decoupling steady linear system in the rectangular coordinates system. Figure 3 illustrates the block diagram of its equivalent structure.

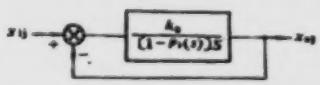

Figure 3. Block diagram of the equivalent structure for velocity feedback

In the diagram $x_{i1} = x_i$, $x_{i_2} = y_i$, $x_{i3} = z_i$, $x_{01} = x_0$, $x_{02} = y_0$, $x_{03} = y_0$. This result is somewhat unexpected. The velocity tracking regenerative feedback system is a steady system in rectangular coordinates. Since we have converted the system into a steady linear system in rectangular coordinates, the analysis and design procedures of this type of a system can be carried out using the frequency method in the classical theory of cybernetics. The only difference is that such analysis and design procedures are carried out in the rectangular coordinates system, not in the spherical coordinates system. Also, according to the properties of the operator of the s function previously described, these operator functions are the transfer functions of this system in the ordinary sense by classical definition.

For example, the operator before the term X_T on the right side of equation (33) can be directly understood as the transfer function of the error of the system. Let us explain with an example. Let

$$P_1(s)=P_2(s)=P_3(s)=\frac{1}{(1+\tau s)^4}$$

$$\frac{[E-P(s)]s}{k_0E-[E-P(s)]s}=\frac{1}{k_0}\left\{4\tau s^2-10\tau^2s^3+\left(20\tau^2-\frac{16\tau^2}{k_0}\right)s^4+\cdots\cdots\right\}$$

The lagging error of powered flight

$$\Delta X_T=\frac{4\tau}{k_0}\frac{dV_T}{dt}-10\tau^2\frac{d^2V_T}{dt^2}+\cdots\cdots$$

When the target flies in a straight line at uniform velocity, the system will not produce a lagging error in tracking because V_T^{I} = V_T^{II} = ... = 0. If the target flies in the x direction at acceleration a, then

$$\Delta X_T = 4\tau a/k_0$$

When k_0 = 10 1/s, τ = 0.1s, = 5g, Δx_T = 1.8 m.

The second term in equation (33) is the random error. It can be described by the noise channel frequency band of the equivalent closed domain transfer function before N_i.

Some characteristics of the property and the design of the regenerative feedback tracking system will be discussed later. Now, let us study the solution of the operator equation (28) in a more general situation. The key to the problem is to find the inverse operator of the left side of the equation. For this, we need to study the characteristics of W(s)B(s) in the operator on the left side of the equation. We have seen in the process of solving $\Delta\Psi$ of the tracking velocity of a symmetrically structured regenerative feedback system that under ideal conditions, W(s)B(s) = E/k_0 is a constant matrix with equal diagonal elements. Therefore we can exchange the order of multiplication of the matrix and A_T^{-1}. But in actual engineering, because of the limitations in technology and testing techniques, the structure of each channel is not symmetric and the operator W(s)B(s) is not a constant matrix. Therefore, studying the solution of the operator equation when the system departs from a symmetric structure and when the transfer functions $k_i(s)$ (i = 1, 2 3) of the main channels are not ideal integral domains has important practical significance. Even though in the actual sytem, the situation will not be like those discussed above, W(s)B(s) = E/k_0, having an infinite frequency bandwidth, but it can almost always be regarded that W(s)B(s) has a sufficiently wide frequency band. Thus, from the discussion in Appendix I we know that at this time, if the diagonal elements of W(s)B(s) and A_T^{-1} can be exchanged without bringing about visible errors in calculation. To solve the difficulty of unequal diagonal elements of W(s)B(s) caused by structural asymmetry, we subject the operator on the left side of equation (28) to the following transformation. Let

$$U=\{E+W(s)B(s)A_T^{-1}[E-P(s)]sA_T\} \tag{34}$$

$$C\triangleq\frac{1}{3}\sum_{i=1}^{3}W_i(0)\beta_i(0)\begin{bmatrix}1/W_1(0)\beta_1(0) & 0 & 0\\ 0 & 1/W_2(0)\beta_2(0) & 0\\ 0 & 0 & 1/W_3(0)\beta_3(0)\end{bmatrix} \tag{35}$$

In this way, the operator W(s)B(s)C can be regarded as symmetric within a very wide frequency band. Thus,

$$\begin{aligned}U&=\{E+W(s)B(s)CC^{-1}A_T^{-1}[E-P(s)]sA_T\}\\&=C^{-1}A_T^{-1}\{E+W(s)B(s)C[E-P(s)]s\}\\&\quad\cdot\{E+(E+W(s)B(s)C[E-P(s)]s)^{-1}A_T(C-E)A_T^{-1}\}A_T\end{aligned} \tag{36}$$

The inverse of U

$$\begin{aligned}U^{-1}&=A_T^{-1}\{E+(E+W(s)B(s)C[E-P(s)]s)^{-1}A_T(C-E)A_T^{-1}\}^{-1}\\&\quad\cdot\{E+W(s)B(s)C[E-P(s)]s\}^{-1}A_TC\end{aligned} \tag{37}$$

Let $$R=E+(E+W(s)B(s)C[E-P(s)]s)^{-1}A_T(C-E)A_T^{-1} \tag{38}$$

then $$U^{-1}=A_T^{-1}R^{-1}\{E+W(s)B(s)C[E-P(s)]s\}^{-1}A_TC \tag{39}$$

In appendix II, we have found the series for R^{-1}, and we have proven that when the system does not depart a lot from symmetry, we can regard $R^{-1}=E$. Appendix II gives the error brought about by such an approximation. Thus we have

$$U^{-1}=A_T^{-1}\{E+W(s)B(s)C[E-P(s)]s\}^{-1}A_TC \tag{40}$$

Mutiplying the two sides of the operator equation (28) by the inverse operator U^{-1} on the left, we obtain the formula for calculating the tracking error of the system:

$$\begin{aligned}\Delta\Psi&=A_T^{-1}\{F+W(s)B(s)C[E-P(s)]s\}^{-1}A_TC[W(s)-E]\Psi_T\\&\quad+A_T^{-1}\{E+W(s)B(s)C[E-P(s)]s\}^{-1}A_TCW(s)B(s)A_T^{-1}[W(s)-E]A_Ts\Psi_T\\&\quad+A_T^{-1}\{E+W(s)B(s)C[E-P(s)]s\}^{-1}A_TCW(s)N,\end{aligned} \tag{41}$$

According to this formula, when the system's structural parameters and the parameters of motion of the target are given, we can calculate the tracking error of the system. The tracking error consists of three parts: the first

term in the formula is the error caused by imperfections ($W(s) \neq E$) in the design of the system or manufacturing. We call it the mismatching error. To eliminate this error in equation (27) so that $W(s) = E$, the following must be satisfied:

$$K(s)B(s)s = E \tag{42}$$

This equation is called the system's matching condition. The meanings of the second and third terms on the right side of equation (41) correspond respectively to the meanings of the first and the second terms of equation (31).

To further simplify engineering computation, we see that because the operator before A_T in the first term on the right side of equation (41) is a symmetric operator, and relative to A_T, the frequency band is very wide, thus, based on the discussion in Appendix I, A_T can be moved to the front. The A_T in the second term can be moved to the back of $CW(s)B(s)$. The third term requires the following transformation. Let

$$C_0=\frac{1}{3}\sum_{i=1}^{3}W_i(0)B(0), \quad C_1=C_0B^{-1}(0), \quad C_2=W^{-1}(0) \tag{43}$$

Then C defined by equation (35) is

$$C = C_1C_2 \tag{44}$$

In equation (41), the operator in the third term

$$A_T\ CW(s) = A_T\ C_1C_2W(s) \tag{45}$$

$C_2W(s)$ is symmetric within a very wide frequency band, therefore we have

$$A_T\ CW(s) = C_2W(s)A_TC_1 \tag{46}$$

Considering the above discussion, equation (41) becomes

$$\begin{aligned}\Delta\Psi=&\frac{C[W(s)-E]}{E+CW(s)B(s)s[E-P(s)]}\Psi_T\\&+A_T^{-1}\frac{CW(s)B(s)[E-P(s)]}{E+CW(s)B(s)s[E-P(s)]}A_Ts\Psi_T\\&+A_T^{-1}\frac{C_1W(s)}{E+CW(s)+B(s)s[E-P(s)]}A_TC_1N_i\end{aligned} \tag{47}$$

If the mismatching error of the system is expressed in spherical coordinates $\Delta\Psi_D$, and the error caused by powered flight of the target and the error caused by the input interference N_i are expressed in rectangular coordinates ΔX_T, ΔX_N, then

$$\Delta\Psi_D=\frac{C[W(s)-E]}{E+CW(s)B(s)s[E-P(s)]}\Psi_T$$
$$\Delta X_T=\frac{CW(s)B(s)[E-P(s)]s}{E+CW(s)B(s)s[E-P(s)]}X_T \qquad (48)$$
$$\Delta X_N=\frac{C_2W(s)}{E+CW(s)B(s)s[E-P(s)]}\Delta X_{ei}$$

Here, $\Delta X_{ei} \triangleq A_T C_1 N_i$. It is the expression of the rectangular coordinates of the equivalent random interference C_1N_i of the input after the random interference N_i of the input has been weighted by the matrix C_1. It can be seen from equation (48) that even when the system structure is asymmetric and when the matching condition (42) is not satisfied, the system can still become a steady linear system. Also, because all the operators on the right side of equation (48) are diagonal matrices, the components of each coordinate system are mutually decoupled. Therefore, calculations of the design of the system can be carried out according to the above equation by the well-known frequency method in the classical theory of cybernetics. The only difference is that the analytical calculation of the mismatching error is carried out in spherical coordinates while the analytical calculation of the lagging error in tracking caused by the powered flight of the target and the random error caused by input random interference are carried out in rectangular coordinates.

An asymmetrically structured and mismatched regenerative feedback system for tracking velocity is given in the following as an example to further explain the effects upon the performance of the system by these two unideal factors.

Let the open domain gain of each main channel of the system be unequal, as follows:

$$K(s)=\frac{1}{s}\begin{bmatrix}k_1 & 0 & 0\\ 0 & k_2 & 0\\ 0 & 0 & k_3\end{bmatrix}=\frac{k}{s}, \qquad k=\begin{bmatrix}k_1 & 0 & 0\\ 0 & k_2 & 0\\ 0 & 0 & k_3\end{bmatrix} \qquad (49)$$

To eliminate the mismatching error of the system, we can take $B(s) = E/k_0$ according to the matching condition (42). But because of the limitations in the precision of manufacturing the components and the precision of adjustment of the system, actually

$$B(s)=\frac{E+\xi}{k}, \qquad \xi=\begin{bmatrix}\xi_1 & 0 & 0\\ 0 & \xi_2 & 0\\ 0 & 0 & \xi_3\end{bmatrix} \qquad (50)$$

ξ is called the mismatching matrix of the system. Substituting (49) and (50) into equations (27), (35) and (44) and (45), we have

$$W(s)=k/(k-\xi s), \quad C=C_0k/(E+\xi), \quad C_1=E, \; C_2=C \qquad (51)$$

Equation (48) can be written as:

$$\Delta\Psi_D=\frac{(E+\xi)^{-1}\xi s}{k_0'E+[E-P(s)]s-\frac{\xi}{k_0'k}s}\Psi_T$$

$$\Delta X_T=\frac{[E-P(s)]s}{k_0'E+[E-P(s)]s-\frac{\xi}{k_0'k}s}X_T$$

$$\Delta X_N=\frac{k_0'E}{k_0'E+[E-P(s)]s-\frac{s}{k_0'k}s}\Delta X_i \qquad (52)$$

The $k_0' \triangleq C\bar{0}^1$ in the formula is an equivalent open domain gain. When the system structure is symmetric and when there is no mismatching, $k_0' = k_0$. Therefore, k_0' is a quantity of the same magnitude as the system's open domain gain. Thus, the s term in the denominator in the above equation can be neglected. The second and third terms in equation(52) and equation (33) have completely different forms. The difference is that k in the latter has been changed to k_0' E. From this we conclude that asymmetry of the system exerts a very slight effect upon the performance of the system. The mismatching of the system only causes the system to produce a mismatching error $\Delta\Psi_D$, for example, when $k_0' = 10 \cdot 1/s$, $\xi_2 = 0.1$, and when the azimuth velocity of the target $\alpha' = 1/s$, $\Delta\alpha = 10^{-2} = 10$ milliradians. Therefore, the mismatching error in tracking caused by mismatching is serious, and this should be fully taken into consideration.

When the system is structurally symmetric, C = E, equation (48) becomes

$$\Delta\Psi_D=\frac{W(s)-E}{E+W(s)B(s)s[E-P(s)]}\Psi_T$$

$$\Delta X_T=\frac{W(s)B(s)[E-P(s)]s}{E+W(s)B(s)s[E-P(s)]}X_T$$

$$\Delta X_N=\frac{W(s)}{E+W(s)B(s)s[E-P(s)]}\Delta X_i \qquad (53)$$

Or from equation (27), we have:

$$\Delta\Psi_D=\frac{K(s)B(s)s-E}{E+K(s)-K(s)B(s)sP(s)}\Psi_T$$

$$\Delta X_T=\frac{K(s)B(s)s[E-P(s)]}{E+K(s)-K(s)B(s)sP(s)}X_T$$

$$\Delta X_N=\frac{K(s)}{E+K(s)-K(s)B(s)sP(s)}\Delta X_i \qquad (54)$$

When the system is structurally symmetric and is matching, $\Delta Y_D = 0$

$$\Delta X_T = \frac{E - P(s)}{K(s) + E - P(s)} X_T$$

$$\Delta X = \frac{K(s)}{K(s) + E - P(s)} \Delta X_i \tag{55}$$

At this time, the equivalent open domain transfer function of the system is

$$K_\sigma(s) \triangleq \frac{K(s)}{E - P(s)} \tag{56}$$

The characteristics of the expression of the flight orbit of the target in rectangular coordinates are high velocity and low acceleration. Therefore, according to the classical theory of cybernetics, $K\sigma(s)$ should be designed as a type II system which includes two integral domains. For example, we can design K(s) as a type I system which includes one integral domain and design P(s) as a low-pass wave filter with P(o) = E. Of course, it is not necessary to make K(s) into an ideal integrator, the important thing is to satisfy equation (42) of the matching condition.

Because the acceleration of the rectangular coordinates of the target is small, the equivalent open domain gain of the system can be made very small. Thus, the bandwidth of the closed domain of the system can be very small [the operator of the second equation in equations (55) is an equivalent closed domain transfer function], so that the ability of the system to suppress interference is greatly improved.

To prove the accuracy of the analytic formula of the tracking error obtained above, we used equation (54) of this article for analytic calculations of the two examples of nonlinear differential equations of the system solved directly using a digital computer in reference[2,3]. The results showed that the two were entirely consistent. In addition, analytic calculations can also clearly point out the nature of the error of each segment which the solution obtained by computer cannot do.

IV. Conclusion

(1) The regenerative feedback tracking system is a nonlinear multiple input and multiple output system in spherical coordinates. But in the analysis of performance after the system enters the tracking status, it can be changed to a steady linear system of rectangular coordinates or of mixed rectangular and spherical coordinates. Therefore it can be systematically designed and analyzed by the frequency method in the classical theory of cybernetics based on the computational formula obtained in this article.

(2) Intrinsically, the regenerative feedback system is a type of tracking system in rectangular coordinates. Besides the fact that the mismatching error belongs intrinsically to the spherical coordinates system, understanding of all the properties of the system and analysis of the performance must all be considered in rectangular coordinates. Therefore, this type of a

system is completely different from the classical tracking system in spherical coordinates. For example, it can cause the random interference of spherical coordinates to produce mutually intersecting effects, and steady state errors in angular tracking in the spiral sections noted in reference [2] will emerge, etc.

(3) Since the system has been converted to a steady linear system in rectangular coordinates, the conflict between speed and resistance to interference inherent in the steady linear system will not change. Therefore, the problem of optimum design of the system still exists. For example, we can appropriately select the equivalent open domain transfer function defined by equation (56) to design the system into a Wiener filter. But the regenerative feedback system into a Wiener filter. But the regenerative feedback system still eases the conflict between speed and resistance to interference greatly. This is because the rectangular coordinates system is an inertia coordinates system, and the representation of the patterns of motion of the target in inertia coordinates has the narrowest frequency spectrum, therefore we can design the frequency band of the system to be very narrow. This means that good speed can be obtained with a very low open domain gain. This is the fundamental reason that the precision of tracking by the regenerative feedback system is much higher than the classical system.

(4) The main point in the design of the system is the matching condition of the system. Even though complete matching cannot be realized, the mismatching error $\Delta\Psi_D$ should be controlled within the allowable range. To assure good matching by the system, the parameters of the transfer functions K(s) and B(s) must be very stable and precise. Therefore, the deep inverse feedback technique and digital techniques are very important to systems with a high tracking precision. Symmetry in the structure of each channel and designing K(s) as an ideal integrator are not principles that must be followed in designing the system.

[Appendix I] The Problem of Exchanging the Order of Mutiplication of W(s)B(s) and A_A^{-1}

Let $H(s)\triangleq W(s)B(s)$, $f(t)\triangleq A_T^{-1}$, $g(t)\triangleq[E-P(s)]sA_T\Delta\Psi$, then changing the order of multiplication of the operators W(s)B(s) and A_T^{-1} in equation (28) will produce an error

$$\Delta(t)\triangleq H(s)f(t)g(t)-f(t)H(s)g(t) \tag{I-1}$$

Let $F(\omega)$ and $G(\omega)$ be the Fourier transforms of f(t) and g(t) respectively, then

$$\Delta(t)=\frac{1}{4\pi^2}\left\{\int_{-\infty}^{\infty}H(j\omega)e^{j\omega t}\int_{-\infty}^{\infty}F(\omega-\xi)G(\xi)d\xi\,d\omega-\int_{-\infty}^{\infty}F(\eta)e^{j\eta t}d\eta\cdot\int_{-\infty}^{\infty}H(j\xi)G(\xi)e^{j\xi t}d\xi\right\}$$

Because H, F, G are all ordinary complex matrices, and H is also a diagonal matrix with the same diagonal elements, we have HF=FH. The above equation becomes

$$\Delta(t)=\frac{1}{4\pi^2}\int_{-\infty}^{\infty}\left\{\int_{-\infty}^{\infty}[H(j\xi+j\eta)-H(j\xi)]F(\eta)e^{j\eta t}d\eta\right\}G(\xi)e^{j\xi t}d\xi \tag{I-2}$$

It can be seen from this that within the range of the frequency band of $F(\eta)$ and $G(\xi)$, $\Delta H(\xi)\triangleq H(j\xi+j\eta)-H(j\xi)$ is very small, thus the $\Delta(t)$ relative to the first term in equation (I-1) is a high order infinitessimal quantity, and therefore the error caused by the exchange of operators can be neglected. The frequency band of $F(\eta)$ of the actual system is smaller than 1 rad/s; the frequency band of $G(\xi)$ is smaller than 10 rad/s, and the frequency band of $H(j\xi)$ is much wider. Therefore, the above conditions can almost always be satisfied in actual engineering. For example, for a mismatched velocity feedback system, we have:

$$K(s)=\frac{k_0}{s(1+Ts)}E, \qquad B(s)=\frac{1}{k_0}E, \qquad H(s)=W(s)B(s)=\frac{E}{k_0+Ts^2}$$

$$H(j\xi)=\frac{E}{k_0-T\xi^2}, \qquad \Delta H(j\xi)\doteq H'(j\xi)j\eta=\frac{2T\xi\eta}{(k_0-T\xi^2)^2}$$

Let $k_0 = 10\cdot 1/s$, $T = 10^{-2}$, then at $\xi = 10$, $\eta = 1$, the relative error caused by the exchange of the above operators is:

$$\left|\frac{\Delta H(j\xi)}{H(j\xi)}\right|=\left|\frac{2T\xi\eta}{k_0-T\xi^2}\right|=2.2\times 10^{-1}$$

[Appendix II] Finding the Inverse of the Operator R in Equation (38)

Although we cannot obtain the closed solution of the inverse operator R^{-1}, we can obtain its series expression, and we can prove that this series has a very fast converging rate so that in engineering calculations we can approximately take $R^{-1} = E$. Let $M(s)\triangleq(E+W(s)B(s)C[E-P(s)]s]^{-1}$, $T(t)\triangleq A_T(C-E)A_T^{-1}$,

then equation (38) becomes

$$R = E + M(s)T(t) \tag{II-1}$$

The theory of functional analysis proves[4] that if the norm of the operator $M(s)T(s)$ is smaller than 1, i.e., $\|M(s)T(t)\|<1$, then the inverse R^{-1} of R can be represented by the following series

$$R^{-1}=\sum_{k=0}^{\infty}(-1)^k[M(s)T(t)]^k \tag{II-2}$$

When we take the finite term of the series as an approximation, it becomes

$$R^{-1}\doteq\sum_{k=0}^{n}(-1)^k[M(s)T(t)]^k \tag{II-3}$$

Thus the approximate error is not larger than η:

$$\eta=\frac{\|M(s)T(t)\|^{n+1}}{1-\|M(s)T(t)\|} \tag{II-4}$$

According to the operator theory of functional analysis, we have:

$$\| M(s)T(t) \| \leq \| M(s) \| \cdot \| T(t) \| \tag{II-5}$$

Therefore, the problem of finding R^{-1} becomes a problem of estimating the values of the norms of M(s) and T(t). Because we are concerned about the size of the absolute deviation of each component of the tracking error, it is very natural to discuss this problem in the functional space C(0, ∞). In C(0, ∞), for any vector

$$X(t) = [x_1(t), x_2(t), x_3(t)]^T \tag{II-6}$$

its norm is defined as:

$$\| X \| \triangleq \max_{j \in J} | x_j(t) | \tag{II-7}$$

J represents the index set of each component of X(t) [J=(1,2,3)], and the norm of any linear operator A is defined as:

$$\| A \| \triangleq \sup_{\|X\|=1} \| AX \| \tag{II-8}$$

The symbol "sup" means taking the upper bound of $\|AX\|$ of all $\|X\| = 1$ where $\|X\|=1$ X_ε C(0,∞).

According to the definitive equations (7) and (8) and considering that the effect of M(s) upon the signals is a kind of convolutional operation, it is not difficult to find[4]

$$\| M(s) \| = \max_{i \in J} \int_0^\infty | m_i(t) | \, dt \tag{II-9}$$

$$\| T(t) \| = \max_{i \in J} \sum_{j=1}^{3} | T_{ij}(t) | \tag{II-10}$$

where $m_i(t)$ is the pulse response corresponding to the ith diagonal element of M(s). $T_{ij}(t)$ represents the element at the ith row and the jth column of the number matrix T(t). The norm of the matrix defined by equation (10) is called the ∞--norm. Matrix theory proves[5] that for any two matrices A and B in n-dimensional space, when A is a nonsingular matrix, we have:

$$\| ABA^{-1} \|_\infty = \| B \|_\infty, \tag{II-11}$$

where v is the ∞--norm of the matrix B:

$$v = \| B \|_\infty = \max_{i \in J} \sum_{j=1}^{3} | B_{ij} | \tag{II-12}$$

Let $A = A_T$, $B = C - E$, then besides the two reporting points of $\varepsilon_T = \pm\frac{\pi}{2}$ A_T is nonsingular, and B is a diagonal matrix, thus we can find the ν--norm of B:

$$\|B\|_\nu \triangleq \sup_{\|x\|_\nu=1} \|BX\|_\nu \triangleq \sup \frac{\left\{\sum_{i=1}^{n}\left|\sum_{j=1}^{n} B_{ij}x_j\right|^\nu\right\}^{1/\nu}}{\left(\sum_{i=1}^{n}|x_i|^\nu\right)^{1/\nu}} =$$

$$= \sup \frac{\left(\sum_{i=1}^{n}|B_{ii}x_i|^\nu\right)^{1/\nu}}{\left(\sum_{i=1}^{n}|x_i|^\nu\right)^{1/\nu}} = \max_{i,j}|B_{ii}| \qquad \text{(II-13)}$$

From equations (10), (11), (13), we obtain

$$\|T(t)\| = \|T(t)\|_\infty = \|A_T(C-E)A_T^{-1}\|_\infty = \|C-E\|_\infty = \max_{i,j}|C_{ii}-1| \qquad \text{(II-14)}$$

Substituting equations (9) and (14) into equations (5), we obtain the estimated value of the norm of the operator M(s)T(t)

$$\|M(s)T(t)\| \leq \max_{i,j}|C_{ii}-1| \cdot \int_0^\infty |m_i(t)|\,dt \qquad \text{(II-15)}$$

When we consider the actual system, we should always make $W(s)|_s = j_\omega \approx 1$ within a very wide range of the frequency band. But in the article, $C_2 = 1$ in equation (48). Referring to the definitive equation for M(s) and equation (48) in the article we know that actually M(s) approximately equals the transfer function of the closed domain of the system with the approximation equation

$$\int_0^\infty |m_i(t)|\,dt \approx \int_0^\infty m_i(t)\,dt = 1 \qquad \text{(II-16)}$$

Therefore we have

$$\|M(s)T(t)\| \leq \max_{i,j}|C_{ii}-1| \qquad \text{(II-17)}$$

i.e., the norm of the operator M(s)T(t) is not larger than the imbalance of the structure of the channel. For example, when $|C_{ii}-1| \leq 0.05$, if we take $R^{-1} = E$, then the error of approximation $\eta \leq 0.053$. If we take $R^{-1} = E-M(s)T(t)$, then $\eta \leq 2.6 \times 10^{-3}$. It can be seen from this that for smaller deviations due to imbalance (such as $|C_{ii} - 1| \leq 0.1$), taking $R^{-1} = E$ as the approximate solution of the inverse operator of R is completely sufficient for engineering calculations.

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FFT To Resolve Acquisition, Tracking in Pulsed-Doppler Radars

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 6, 1981 pp 13-22

[Article by Tong Kai [4547 6963] of the Beijing Institute of Tracking, Telemetry and Control: "Application of the FFT Technique in Resolving Acquisition and Tracking Problems of Targets With High Velocity and High Acceleration in Pulsed-Doppler Radars"; This article was received in January, 1980, finalized in April 1981]

[Text] Abstract

This article analyzes the ambiguity functions of velocity and acceleration of FFT digital signal processing equipment in a pulsed Doppler precise tracking radar, and it establishes a model for an ambiguity graph of 32 dots. It also applies the methods of number theory to derive a computational formula for the distribution of side lobes under high acceleration, and proposes a method of preprocessing FFT velocity and acceleration by digital matching of the acceleration phase of a target in motion. This type of processing equipment can replace the digital-analog time compressor currently used.

I. Foreword

When a target undergoes high acceleration, acquisition of the target by the velocity tracking circuit has been a relatively difficult problem. To ensure

that the velocimeter circuit acquires the target reliably, the circuit must use differential smoothing of the signals over distance to roughly define the velocity and acceleration, and furthermore, precisely defined corrections of velocity and acceleration are needed so that a certain spectral line near the roughly defined velocity falls in the narrow band of the wave filter and is retained for a sufficient period of time to accomplish acquisition. For this, many radars[1,2,3] use a time compressor system. This system is actually a target velocity and acceleration detection system. Its processing is analog.

The purpose of this article is to explore the output characteristics of the frequency spectrum of FFT digital wave filters when the target undergoes high acceleration, to use methods of numerical computation to find the ambiguity graph of the FFT velocity and acceleration, to use analytic methods to find the patterns of variation of the ambiguity graph, and to propose a plan for preprocessing FFT signals to match the acceleration phase. This means that all-digital equipment can be used to replace the time compressor to accomplish the functions of processing the target's velocity and acceleration, thus improving the equipment's reliability, precision and total processing time.

II. DFT of the Complex Time Function

The frequency wave form of a coherently pulsed serial echo can be expressed as:

$$u(t)=A(t)\sin[\omega_0 t+\varphi_d(t)] \tag{1}$$

$$\varphi_d(t)=\int\omega_d(t)dt=2\pi\int f_d(t)dt \tag{2}$$

where A(t) is the echo envelope, F_r is the repeat frequency, τ is the width of the echo pulse (its amplitude is limited), and $f_d(t)$ is the Doppler shift. After the orthogonal phase is detected, the amplitude normalized and digitized, we can obtain:

$$I_k=\cos\varphi_d(t_k)=\cos\varphi_d(kT)=\cos\varphi_d(k)\bullet$$
$$Q_k=\sin\varphi_d(t_k)=\sin\varphi_d(kT)=\sin\varphi_d(k)$$

In the equations, k = -1, 0, 1, ... When using complex time functions to represent them, they can be written as:

$$g(k)=I_k+jQ_k=\cos\varphi_d(k)+j\sin\varphi_d(k)=\exp j\varphi_d(k) \tag{3}$$

• $\varphi_d(k)$ is the abbreviation of $\varphi_d(kT)$.

The discrete Fourier transform of equation (3) is:

$$g(k)=\frac{1}{N}\sum_{n=0}^{N-1}G(n)W^{-nk},\quad k=0,1,\cdots,N-1 \tag{4}$$

$$G(n)=\sum_{k=0}^{N-1}g(k)W^{nk},\quad n=0,1,\cdots,N-1 \tag{5}$$

$$W=\exp(-j2\pi/N) \tag{6}$$

where G(n) is a discrete spectrum, T is the sampling period, N is the number of transformation points. Among them, G(n) can also be regarded as the output of a linear digital wave filter over the time intervals (N-1)T. Its normalized transfer function

$$|H(n)|=\left|\frac{\sin[\pi f_d/(F_r/N)]}{\sin\left[\frac{\pi}{N}\left(\frac{f_d}{F_r/N}-n\right)\right]}\right| \tag{7}$$

III. Ambiguity Function of Velocity and Acceleration

Suppose that the echoes are sampled synchronously over distance. Then the problem of distance mismatching does not exist. Definition: When the velocity and acceleration of a target is mismatched with the nth wave filter, the value of the ambiguity function is the normalized output of that wave filter. To simplify the expression, let n=0, and at this time, the wave filter matches $f_d = 0$, therefore the velocity and acceleration of the target itself are the mismatched amounts of that wave filter. This does not lose the generality in analyzing the problem.

When the target undergoes uniform acceleration, the variation of $f_d(t)$ is illustrated in Figure 1, and we have

$$f_d(t)=f_d+f'_d t,\quad \varphi_d(t)=2\pi[f_d t+(f'_d t^2/2)]+\varphi_0 \tag{8}$$

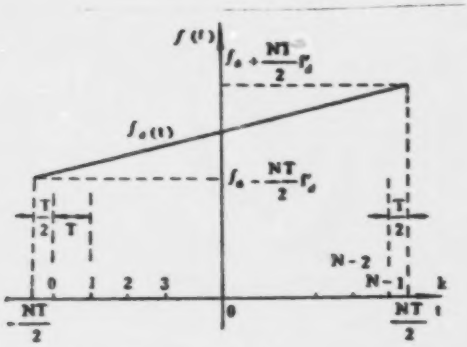

Figure 1. Variation of $f_d(t)$ at uniform acceleration

Substituting t = [k - (N-1)/2]T, k = 0, 1, ..., N-1 in the above equation and rearranging the terms, we obtain

$$\varphi_d(k)=\frac{2\pi}{N}\left[k\alpha-\frac{(N-1-k)k}{N}\beta\right]+\varphi_0' \tag{9}$$

In equation (9), $2\pi k\alpha/N$ represents the phase change of the average frequency f_d at kT. Here, $\alpha = f_d/(F_r/N)$. It is the normalized value of the frequency which represents the total number of periods within the time NT, and F_r/N represents the unit of resolution of the frequency. The second term represents the phase shift of f_d' at time kT. Here, $\beta = f_d'/(2F_r^2/N^2)$, which is the normalized value of frequency variation. It is one-half the product of time and bandwidth of the linear modulated frequency wave within the length of time from 0 to NT (i.e., f_d' NT·NT/2), where, $2F_r^2/N^2$ is the unit of resolution of frequency variation. The third term φ_0 is the initial phase after rearranging the terms.

Substituting equation (9) into equations (3) and (5), we can obtain the discrete spectrum of the echo signals when the target has a velocity and acceleration

$$G_{\alpha,\beta}(n)=\sum_{k=0}^{N-1}W^{[-(\alpha-n)k+\beta(N-1-k)k/N]} \tag{10}$$

In the above equation, the initial phase φ_0' has been deleted. When $\alpha = \beta = n = 0$, $G_{0,0}(0) = N$. From this, we can write the ambiguity function of the velocity and acceleration:

$$\chi(\alpha,\beta)=\left|\frac{G_{\alpha,\beta}(0)}{G_{0,0}(0)}\right|=\frac{1}{N}\left|\sum_{k=0}^{N-1}W^{[-\alpha k+\beta(N-1-k)k/N]}\right| \tag{11}$$

We know from Appendix I that because of the symmetry of the function $X(\alpha,\beta)$, the distribution graph of the entire function $X(\alpha,\beta)$ can be obtained if we limit our discussion within the range $0 \leqslant \alpha < N/2$ and $0 \leqslant \beta \leqslant N^2/4$, as shown in Figures 2 and 3. Figure 4 shows a three-dimensional model of the ambiguity graph of velocity and acceleration. In these figures, we have taken N = 32.

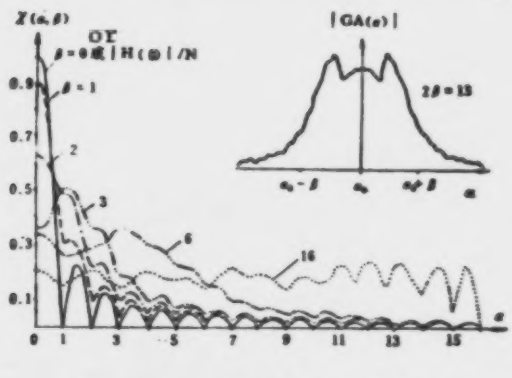

Figure 2. Curve of $X(\alpha,\beta)$-α when β = 0,1,2,3,6 and 16.

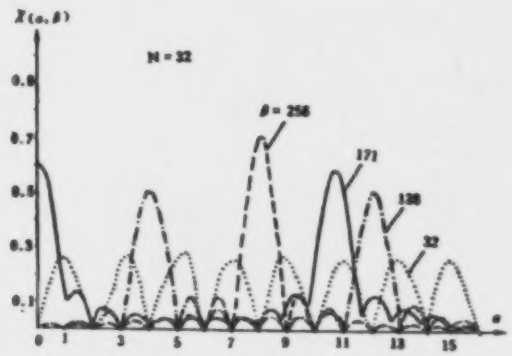

Figure 3. The curve of $X(\alpha,\beta)$-α when β = 32, 128, 171 and 256.

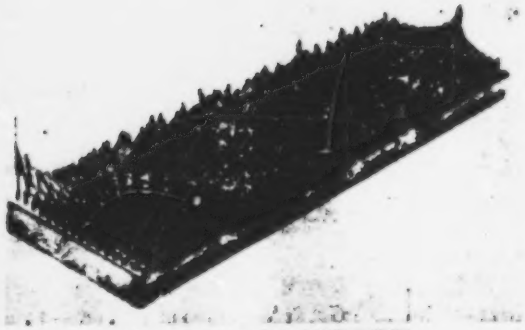

图4 速度、加速度立体模糊图模型

Figure 4. Three-dimensional model of the ambiguity graph of velocity and acceleration.

IV. Analysis of the Ambiguity Diagram

When finding the discrete spectrum G(n) of a finitely long discrete time function g(k), we can decompose it into the following steps[6]:

1. Multiplying the continuous function g(t) by the sampling function $\Delta_0(t)$ and the intercept function a(t), we obtain

$$g(k) = g(t)\Delta_0(t)a(t);$$

2. Then we find the continuous frequency spectrum of g(k)

$$G\Delta_0A(f) = GA(f) * \Delta_0(f) = G\Delta_0(f) * A(f) \tag{12}$$

where $\Delta_0(f)$, A(f), GA(f) and $G\Delta_0(f)$ are the frequency spectra of $\Delta_0(t)$, a(t), g(t)a(t), $g(t)\Delta_0(t)$ respectively.

3. Multiplying $G\Delta_0A(f)$ by the frequency spectrum sampling function $\Delta_1(f)$, we have

$$G\Delta_0A(f)\Delta_1(f) = \sum_{n=-\infty}^{\infty} G\Delta_0A\left(\frac{n}{NT}\right)\delta\left[f-\frac{n}{NT}\right]$$

Thus, we obtain the discrete spectrum $G(n) = G\Delta_0A(n/NT)$.

To find $X(\alpha,\beta)$, we first find $G_{\alpha,\beta}(0)$ according to equation (11). The value of $G_{\alpha,\beta}(0)$ is $G\Delta_0A(0)$. To simplify analysis, we interchange $-\alpha$ and n according to equation (10) and obtain $G_{-\eta,\beta}(-\alpha)$, and let $n = 0$. This is equivalent to $f_d = 0$. The α in these equations should be a continuous parameter, therefore,

$$G_{\alpha,\beta}(0) = G_{\alpha,\beta}(-\alpha) = G\Delta_0A(-\alpha)\big|_{\alpha=0} \tag{13}$$

where $\alpha = f/(F_r/N)$, $\alpha_0 = f_d/(F_r/N)$. This is slightly different in meaning than the previous use of α to represent $f_d/(F_r/N)$, please take note.

In the following we will seek an analytic solution:

1. When the product of time and bandwidth is small, the condition is $2\beta < N$. This is equivalent to $f_d'NT < F_r$. Because the value of β is small, the frequency bandwidth of $g(t) \cdot a(t)$ is narrower, therefore, when using F_r for sampling, mixing and overlapping of the main frequency spectra will not occur. Thus, using the method of finding the g(t)a(t) frequency spectrum first is more convenient. g(t)a(t) is a time function of a linear modulated frequency pulse. Its frequency variation is as shown in Figure 1, the largest value of its pulse amplitude is 1, its pulse width is NT, thus its frequency spectrum is

$$GA(f)=\int_{-NT/2}^{NT/2}\exp[j2\pi(f_d t+f_d' t^2/2-ft]dt$$

Solving this integral numerically yields[7]:

$$|GA(\alpha)|=\frac{NT}{2\sqrt{\beta}}\{[C(x_1)+C(x_2)]^2+[S(x_1)+S(x_2)]^2\}^{1/2} \tag{14}$$

In the equation, C(x) and S(x) are Fresnel integrals,
$x_1=\sqrt{\beta}(\beta+\alpha-\alpha_0)/\beta$, $x_2=\sqrt{\beta}(\beta-\alpha+\alpha_0)/\beta$.

Reference [7] also gives the wave form of GA(f). To compare it with the wave form of $\beta = 6$, we have specially introduced into Figure 2 the wave form of $2\beta = 13$ (the width of the passing band is 2β, its central value is α_0).

According to equation (12) and $\Delta_0(f)$, we can obtain:

$$G\Delta_0 A(f)=\frac{1}{T}\sum_{i=-\infty}^{\infty}GA(f-iF_r)\exp[j\pi i(N-1)]$$

According to equation (13), and using α to represent f, we obtain

$$|G_{\alpha,\beta}(0)|=\frac{1}{T}\left|\sum_{i=-\infty}^{\infty}GA(iN-\alpha)\exp[j\pi i(N-1)]\right|_{\alpha_0=0}$$

Because the passing band represented by the normalized GA(α) is about 2β, and to avoid mixing and overlapping of the main frequency spectra, analysis is carried out only for $\beta \leq N/2$. Thus from equation (11) we obtain:

$$\chi(\alpha,\beta)\simeq\frac{1}{NT}\sum_{i=-\infty}^{\infty}|GA(iN-\alpha)|_{\alpha_0=0} \tag{15}$$

When β increases to N from N/2, the main frequency spectra mix and overlap. At this time $X(\alpha,\beta)$ shows wave motion characteristics and gradually extends from the α high end (i.e. at $\alpha = N/2$) towards the low end.

2. When the Product of the Time and Bandwidth Is Large

Because the ambiguity graph shows visible wave motion characteristics when the product of time and bandwidth is large ($2\beta > N$), and even produces high side lobes, therefore, a clear understanding of the amplitude of the peak values of the side lobes and the patterns of distribution has an important meaning. For this, we first seek a way to find the discrete spectral line of $G\Delta_0(f)$, then it will be more convenient to compute $G\Delta_0(f) * A(f)$ according to equation (12). From equations (8) and (9) we can find:

$$G\Delta_0(f)=\int_{-\infty}^{\infty} g(t)\,\Delta_0(t)\exp[-j2\pi ft]\,dt$$

$$=\sum_{k=-\infty}^{\infty}\exp j2\pi\{(f_d-f)kT+[k^2T^2-(N-1)kT^2]f_d'/2+f_d'\}G\Delta_0(-f)\Big|_{f_d=0}$$

$$G\Delta_0(-f)\Big|_{f_d=0}=\sum_{k=-\infty}^{\infty}\exp j2\pi\left[\left(f-\frac{N-1}{2}f_d'T\right)kT+\frac{1}{2}f_d'k^2T^2\right] \tag{16}$$

According to the further derivation of equation (16) shown in Appendix II, we can obtain the following: When $\beta = pN^2/q$, $(p, q) = 1$, and let $q = 2^{\ell}q_1$ (q_1 is an odd number), then we have:

$$|G\Delta_0(-\alpha)|_{\alpha_0=0}=\begin{cases}\dfrac{1}{\sqrt{qT}}\displaystyle\sum_{i=-\infty}^{\infty}\sum_{u=0}^{q-1}\delta\left[\alpha-\left(i+\frac{u}{q}\right)N\right], & \text{Let } \ell=0,\ q=q\\ \dfrac{1}{\sqrt{q/2\,T}}\displaystyle\sum_{i=-\infty}^{\infty}\sum_{u=1,3,5,\ldots}^{q-1}\delta\left[\alpha-\left(i+\frac{u}{q}\right)N\right], & \text{If } \ell=1,\ N \text{ is an odd number; Or, } \ell>1,\ N \text{ is an even number}\\ \dfrac{1}{\sqrt{q/2\,T}}\displaystyle\sum_{i=-\infty}^{\infty}\sum_{u=0,2,4,\ldots}^{q-2}\delta\left[\alpha-\left(i+\frac{u}{q}\right)N\right], & \text{If } \ell=1,\ N \text{ is an even number; Or, } \ell>1,\ N \text{ is an odd number}\end{cases} \tag{17}$$

In the equations, α is the value of normalized f. In addition, the Fourier transform of the known intercept function a(t) is:

$$A(\alpha)=NT\frac{\sin 2\pi\alpha}{2\pi\alpha} \tag{18}$$

From equations (13) and (12) we have:

$$G_{\alpha,\beta}(0)=\int_{-\infty}^{\infty}A(-\tau)[G\Delta_0(-\alpha+\tau)|_{\alpha_0=0}]\,d(-\tau)$$

and we consider

$$\int_{-\infty}^{\infty}A(-\tau)\delta\left[\alpha-\left(i+\frac{u}{q}\right)N-\tau\right]d(-\tau)=A\left[\alpha-\left(i+\frac{u}{q}\right)N\right]$$

$$=NT\frac{\sin 2\pi\left[\alpha-\left(i+\frac{u}{q}\right)N\right]}{2\pi\left[\alpha-\left(i+\frac{u}{q}\right)N\right]}$$

From this and according to equation(11), we can write the approximation formula for the ambiguity function when the main frequency spectra $A\{\alpha-[i+(u/q)]N\}$ do not mutually overlap:

$$\chi(\alpha,\beta)\simeq \begin{cases} \frac{1}{\sqrt{q}}\sum_{i=-\infty}^{\infty}\sum_{u=0}^{q-1}\left|\frac{1}{NT}A\left[\alpha-\left(i+\frac{u}{q}\right)N\right]\right|, & \text{If } \ell=0,\ q=q \\ \frac{1}{\sqrt{q/2}}\sum_{i=-\infty}^{\infty}\sum_{u=1,3,\ldots}^{q-1}\left|\frac{1}{NT}A\left[\alpha-\left(i+\frac{u}{q}\right)N\right]\right|, & \text{If } \ell=1,\ N \text{ is an odd number Or } \ell>1,\ N \text{ is an even number} \\ \frac{1}{\sqrt{q/2}}\sum_{i=-\infty}^{\infty}\sum_{u=0,2,4,\ldots}^{q-2}\left|\frac{1}{NT}A\left[\alpha-\left(i+\frac{u}{q}\right)N\right]\right|, & \text{If } \ell=1,\ N \text{ is an even number Or } \ell>1,\ N \text{ is an odd number} \end{cases} \tag{19}$$

Table 1 gives the amplitudes of the peak values of X (α,β) for each value of β calculated according to equation(17) with N=32 and the positional α values. They coincide completely with the model of the curve of the ambiguity graph computed by the digital computer.

V. Application

Equation (10) shows that transformation matches the phase of the sampled repeat signals first and then their sum is found. Therefore, there will always be one integral value close to α so that $|\alpha - n| \leqslant 1/2$. At this time, the nth wave filter and the signal are basically matched. The amplitude of normalized output (when $\beta = 0$) will be greater than 0.6368 (-3.92dB). Therefore it is not difficult to estimate the approximate value of α of the target from this n value. This kind of digitalmatching can be generalized without difficulty to situations that have acceleration. At this time, equation (10) is generalized to:

$$\begin{aligned} G(m,n) &= \sum_{k=0}^{N-1}\exp j2\pi\left[(\alpha-n)\frac{k}{N}-(\beta-m)\frac{(N-1-k)k}{N^2}\right] \\ &= \sum_{k=0}^{N-1}g(k)W^{nk}M^{m(N-1-k)k} \end{aligned} \tag{20}$$

In the equation, $W = \exp(-j2\pi/N)$, $M = \exp(j2\pi/N^2)$. When m takes a certain integral value, we can always make $|\beta - m| \leqslant 1/2$. If the velocity is matched at this time, i.e., $|\alpha - n| \leqslant 1/2$, then the normalized output of the (n,m) filter will not be much smaller than 0.6368. When m takes only even numbers, $|\beta - m| \leqslant 1$ (still taking $|\alpha - n| \leqslant 1/2$), the normalized output of the (n,m) wave filter will be larger than 0.6340(-3.96dB). W^{nk}, $M^{m(N-1-k)k}$ are called the phase matching factors of velocity and acceleration. Their introduction will not only enable the wave filter to match the velocity of the target, they can also be used to find the approximate acceleration of the target.

Table 1. Distribution of Peak Values of $X(\alpha,\beta)$ When N=32

l	q	Peak value	$\alpha = uN/q$	$\beta = pN^2/q, (p,q)=1$
=0 u takes integers	1	1.000	0.	1024(即0),
	3	0.577	0,10.67,21.33,	341.33,682.67,
	5	0.447	0,6.40,12.80,19.20,25.60,	204.80,409.60,614.40,819.20,
	7	0.378	0,4.57,9.14,13.71,18.29,22.86,27.43,	146.29,292.57,438.86,585.14,731.43,877.71,
	9	0.333	0,3.56,7.11,10.67,14.22,17.78,21.33, 24.89,28.44,	113.78,227.56,455.11,568.89,796.44,910.22,
	11	0.302	0,2.91,5.82,8.73,11.64,14.55,17.45, 20.36,23.27,26.18,29.09,	93.09,186.18,279.27,272.36,465.45,558.55, 651.64,744.73,837.82,930.91,
	13	0.277	0,2.46,4.92,7.39,9.85,12.31,14.77, 17.23,19.69,22.15,24.62,27.08,29.54,	78.77,157.54,236.31,315.08,393.85,472.62, 551.38,630.15,708.92,787.69,866.46,945.23,
	15	0.258	0,2.13,4.26,6.40,8.53,10.67,12.80, 14.93,17.07,19.20,21.33,23.47,25.60, 27.73,29.87,	68.27,136.53,273.07,477.87,546.13,750.93, 887.47,955.73,
=1 u takes even numbers	2	1.000	0.	512.
	6	0.577	0,10.67,21.33,	170.67,853.33,
	10	0.447	0,6.40,12.80,19.20,25.60,	102.40,307.20,716.80,921.60,
	14	0.378	0,4.57,9.14,13.71,18.29,22.86,27.43,	73.14,219.43,365.71,658.29,804.57,950.86,
	18	0.333	0,3.56,7.11,10.67,14.22,17.78,21.33, 24.89,28.44,	56.89,284.44,398.22,625.78,739.56,967.11,
	22	0.302	0,2.91,5.82,8.73,11.64,14.55,17.45, 20.36,23.27,26.18,29.09,	46.55,139.64,232.73,325.82,418.91,605.09, 698.18,791.27,884.36,977.45,
	26	0.277	0,2.46,4.92,7.39,9.85,12.31,14.77, 17.23,19.69,22.15,24.62,27.08,29.54,	39.38,118.15,196.92,275.69,354.46,433.23, 590.77,669.54,748.31,827.08,905.85,984.62,
	30	0.258	0,2.13,4.26,6.40,8.53,10.67,12.80, 14.93,17.07,19.20,21.33,23.47,25.60, 27.73,29.87,	34.13,238.93,375.47,443.73,580.27,648.53, 785.07,989.87,
>1 u takes odd numbers	4	0.707	8,24,	256,768,
	8	0.500	4,12,20,28,	128,384,640,896,
	12	0.408	2,6,8,10,13.33,18.67,24,29.33,	85.33,426.67,597.33,938.67
	16	0.354	2,6,10,14,18,22,26,30,	64,192,320,448,576,704,832,960,
	20	0.316	1.60,4.80,8,11.20,14.40,17.60,20.80, 24,27.20,30.40,	51.20,153.60,358.40,460.80,563.20,665.60, 870.40,972.80,
>1 u takes odd numbers	24	0.289	1.33,4,6.67,9.33,12,14.67,17.33,20, 22.67,25.33,28,30.67,	42.67,213.33,298.67,469.33,554.67,725.33, 810.67,981.33,
	28	0.267	1.14,3.43,5.71,8,10.29,12.57,14.86, 17.14,19.43,21.71,24,26.29,28.57,30.86,	36.57,109.71,182.86,329.14,402.29,475.43, 548.57,621.71,694.86,841.14,914.29,987.43,
	32	0.250	1,3,5,7,9,11,13,15,17,19,21,23,25,27, 29,31,	32,96,160,224,288,352,416,480,544,608,672, 736,800,864,928,992

Because we have assumed that the target is in uniform acceleration and also because the value of f_d is the value at k=(N-1)/2, thus to find the value of f_d at time k=N, we should extrapolate acceleration. The compensating value of extrapolation is $(N+1)T\, f_d'/2 = m(N+1)F_r/N^2$. But we can also calculate the velocity at time t = NT. At this time, we have:

$$f_d(t)=f_d+f_d'(t-NT),$$
$$\varphi_d(t)=2\pi[f_d t+(t^2-2NTt)f_d'/2]+\varphi_0$$

When t = kT, $\varphi_d(k)=2\pi\{ak/N-[\beta(2N-k)k/N^2]\}+\varphi_0$.

Therefore equation (2) becomes:

$$G(n,m)=\sum_{k=0}^{N-1} g(k)W^{nk}M^{m(2N-k)k} \tag{21}$$

The actual method of finding G(n,m) is to multiply the signal g(k) by $M^{m(2N-k)k}$ first to find $g_m'(k) = g(k)M^{m(2N-k)k}$, then subject $g_m(k)$ to FFT to find G(n,m). FFT to find $g_{m+1}(k)$ and to find G(n,m) can be carried out simultaneously.

We will now present a preliminary discussion of the question of choosing the values for N and m as followings: The choice of the value of N is determined by the degree of resolution of velocity measurements. The degree of resolution of velocity is $\delta f_d = F_r/N$, or $\delta R' = \lambda F_r/2N$, where $\delta R'$ is the resolution of velocity, λ is the wavelength. To facilitate treatment of N, we take the power of 2. N=32 is sufficient. When F_r = 320 Hz, λ = 0.05m, thus $\delta R'$ = 0.25 m/s, while the unit of resolution of acceleration is $\delta f_d' = 2F_r^2/N^2$, or $\delta R'' = \lambda F_r^2/N^2$ when m takes integral values. Here, $\delta R''$ is the resolution of acceleration. Under the above parameters, $\delta R''$ = 5 m/s^2. The greatest value of m is limited by the side lobes of the ambiguity graph of velocity and acceleration. Therefore this article has found the pattern of distribution of peak value positions to make it easy to determine the range and the threshold value that m can reach.

When a side lobe smaller than -6dB is taken, and when we consider the possibility that acceleration may be either positive or negative, we realize that |m| should be smaller than $N^2/12$. When N=32, |m| must not be greater than 85, i.e., R''_{max} should be within $\pm\lambda F_r^2/12 = \pm 425$ m/s^2. Therefore, when the target's acceleration is larger than this value, it is necessary to use the value of acceleration smoothed out by the pulsed telemetric signal to roughly define the target's acceleration.

VI. Conclusion

This article has analzyed the ambiguity graph of velocity and acceleration of a target and has established a model of the ambiguity graph using 32 sampling points. It has given the amplitude of the peak values of every side lobe and the position of distribution without loss. It has thus provided a reference for further analysis and engineering design in the future.

The article has also proposed an all digital method of matching the phase of acceleration while simultaneously matching the velocity of a target. This will further the work of digitizing signal processing.

Appendix I

Now let us discuss the symmetry of the function $X(\alpha,\beta)$, where α, β, are not necessarily integers. Due to the limitation of this article, the proof has been omitted.

Property 1: $X(\alpha,\beta)$ has multiple values, i.e.,

$$\chi(\alpha,\beta)=\chi[\alpha(\mathrm{mod}N),\beta(\mathrm{mod}N^2)] \tag{I-1}$$

Property 2: $X(\alpha,\beta)$ is symmetric about the origin, i.e.,

$$\chi(\alpha,\beta)=\chi(-\alpha,-\beta) \tag{I-2}$$

Property 3: $X(\alpha,\beta)$ is symmetric about the axis $\alpha = 0$ and $\alpha = N/2$, i.e.,

$$\chi(\alpha,\beta)=\chi(-\alpha,\beta),\qquad \chi[(N/2)-\alpha,\beta]=\chi[(N/2)+\alpha,\beta] \tag{I-3}$$

Property 4: $X(\alpha,\beta)$ is symmetric about the axis $\beta = 0$ and $\beta = N^2/2$, i.e.,

$$\chi(\alpha,\beta)=\chi(\alpha,-\beta),\qquad \chi[\alpha,(N^2/2)-\beta]=\chi[\alpha,(N^2/2)+\beta] \tag{I-4}$$

Property 5: When N is an odd number, $X(\alpha,\beta)$ is symmetric about the point ($\alpha = N/4$, $\beta = N^2/4$), and when N is an even number, $X(\alpha,\beta)$ is symmetric about the axis $\beta = N^2/4$, i.e.:

$$\chi[(N/4)-\alpha,(N^2/4)-\beta]=\chi[(N/4)+\alpha,(N^2/4)+\beta], \qquad \text{N is odd} \tag{I-5A}$$

$$\chi[\alpha,(N^2/4)+\beta]=\chi[\alpha,(N^2/4)-\beta], \qquad \text{N is even} \tag{I-5B}$$

According to the above properties, we can study the function $X(\alpha,\beta)$ within $0 \leqslant \alpha \leqslant N/2$, $0 \leqslant \beta \leqslant N^2/4$.

Appendix II

When the product of time and bandwidth is large, we can derive the relation of $G\Delta_0(-f)\,|\,f_{d=0}$ which produces a discrete frequency spectrum. We know

$$G\Delta_0(-f)\Big|_{f_{d=0}}=\sum_{k=-\infty}^{\infty}\exp j2\pi\left[\left(f-\frac{N-1}{2}f_s'T\right)kT+\frac{1}{2}f_s'k^2T^2\right] \tag{16}$$

Let $k = rq + x$, where q is any positive integer, $x = 0,1,\ldots,q-1$; $r=0, \pm1, \pm2, \ldots, \pm\infty$. Substituting into the above equation we obtain:

$$G\Delta_s(-f)\Big|_{f_d=0}=\sum_{x=0}^{q-1}\exp j2\pi\left[\left(f-\frac{N-1}{2}f_d'T\right)Tx+\frac{1}{2}f_d'T^2x^2\right]$$

$$\cdot\sum_{r=-\infty}^{\infty}\exp j2\pi\left\{frqT+[-(N-1)+rq+2x]\frac{f_d'}{2}qT^2r\right\}$$

To find the sum of the latter terms of the above equation and to form a discrete frequency spectrum, the main condition is that $[-(N-1)+rq+2x]f_d'qT^2r/2$ be an integer within the chosen values of r and x. Therefore, we should have $f_d' = 2pF_T^2/q$. This is equivalent to $\beta = pN^2/q$, where p, q are relative prime integers, i.e., (p, q) = 1. At this time, the above equation becomes:

$$G\Delta_s(-f)\Big|_{f_d=0}=\frac{1}{qT}\sum_{r=-\infty}^{\infty}\delta\left(f-\frac{rF_r}{q}\right)\sum_{x=0}^{q-1}\exp j\frac{2\pi}{q}\{[x-p(N-1)]x+px^2\}$$

If we let z = iq + u, u = 0, 1, ..., q-1; i = 0, ±1, ±2, ...,±∞ and substitute these into the above equation, we obtain:

$$G\Delta_s(-f)\Big|_{f_d=0}=\frac{1}{qT}\sum_{i=-\infty}^{\infty}\sum_{u=0}^{q-1}\delta\left[f-\left(i+\frac{u}{q}\right)F_r\right]$$

$$\cdot\sum_{x=-1}^{q-1}\exp j\frac{2\pi}{q}\{[u-p(N-1)]x+px^2\} \qquad \text{(II-1)}$$

To find the final summation in equation (II-1), let $s[q, f(x)]=\sum_{x=0}^{q-1}\exp j\frac{2\pi}{q}\cdot f(x)$, while $f(x) = px^2 + [u-p(N-1)]x$, where [p, u-p(N-1), q] = 1. The q can be any nonzero integer, and then let $q=q_1q_2$, q_1 is an odd number, $q_2= 2^{\ell}$, ℓ is a nonnegative integer. According to Theorem 2 on page 197 in reference [10]: If $(q_1, q_2) = 1$, then

$$S(q_1q_2, f(x))=S(q_1, f(q_2x)/q_1)S(q_2, f(q_1x)/q) \qquad \text{(II-2)}$$

where

$$|S(q_1, f(q_2x)/q_2|=\left|\sum_{x=0}^{q_1-1}\exp j\frac{2\pi}{q_1}\{p(2^lx)^2+[u-p(N-1)]2^lx\}/2^l\right|$$

$$=\left|\sum_{x=0}^{q_1-1}\exp j\frac{2\pi p2^l}{q_1}\left[x+\frac{u-p(N-1)+cq_1}{q2^{l+1}}\right]^2\right| \qquad \text{(II-3)}$$

In the equation, c should be an integer. The condition that $[u-p(N-1)+cq_1]/p2^{l+1}$ has an integral solution is $(q_1, p2^{\ell+1})\,|\,[u-p(N-1)]$*1 (i.e., q_1, $p2^{\ell+1}$) is exactly divisible. Because q_1 is an odd number, (p,q) = 1, i.e., $(p,q_1)=1$, therefore, $(q_1, p2^{\ell+1})=1$, while u-p(N-1) is an integer, the above condition is completely satisfied, thus $[u-p(N-1)+cq_1]/p2^{\ell+1}$, can be an integer by appropriately selecting c. Therefore, when x passes through any complete residue system, when modq_1, $x+[u-p(N-1)+cq_1]/p2^{\ell+1}$ also passes through a complete residue system, modq_1, and the result of equation (II-3) becomes

$$|S[q_1, f(q_2x)/q_2]| = \sqrt{q_1} \quad \text{*2} \qquad \text{(II-4)}$$

*1 In reference [10], p 11, Theorem 1 of "the solution of the indeterminate equation of the first degree."

*2 In reference [10], p 178, "Gaussian sum" and pp 128-183, Theorem 6.

In the second term in equation (II-2) we have

$$|S[q_2, f(q_1x)/q_1]| = \left|\sum_{x=0}^{E} \exp j\frac{2\pi pq_1}{2^l}\left[x+\frac{u-p(N-1)+c2^l}{2pq_1}\right]^2\right| \qquad \text{(II-5)}$$

In the equation, $E = 2^l-1$, c is an integer, and the condition for $[u-p(N-1)+c2^l]/2pq_1$ to have an integral solution is $(2^l, 2pq_1)\,|\,[u-p(N-1)]$. Because $(p,q) = 1$, therefore $(p,2^l) = 1$, q_1 is an odd number, and thus when l is a positive number $2^l, 2pq_1) = 2$. At this time, we should differentiate between two situations:

1) When u-p(N-1) is an even number (i.e., N is an even number, u should be odd, and when N is odd, u should be even), $[u-p(N-1)+c2^l]/2pq_1$ is an integer when the value of c is appropriately selected. Therefore, when x passes through a complete residue system, $\bmod 2^l$, $x+[u-p(N-1)+C2^l]/2pq_1$ also passes through a complete residue system, $\bmod 2^l$, thus the results of equation (II-5) can be represented as [10]*3:

$$|S[q_2, f(q_1x)/q_1]| = \begin{cases} 0 & \text{If } l=1 \\ 2^{(l+1)/2} & l>1 \end{cases} \qquad \text{(II-6)}$$

2) When u-p(N-1) is an odd number (i.e., when N is an even number, u should be even, and when N is an odd number, u should be odd), then equation (II-6) is no longer valid. At this time, the value is calculated by the following equation: When $l=1$,

$$|S[q_2, f(q_1, x)/q_1]| = \left|\sum_{x=0}^{1} \exp j\frac{2\pi}{2}\{pq_1x^2+[u-p(N-1)]x\}\right| = 2$$

(2) When $l > 1$,

$$|S[q_2, f(q_1, x)/q_1]| = \left|\sum_{x=0}^{E} \exp j\frac{2\pi}{2^l}\{pq_1x^2+[u-p(N-1)]x\}\right|$$

$$= \left|\sum_{x=0}^{E'} \{1+\exp j\pi[u-p(N-1)]\} \exp j\frac{2\pi}{2^l}\{pq_1x^2+[u-p(N-1)]x\} = 0\right.$$

In the equation, $E' = 2^{l-1}$, $E' = 2^{l-1}-1$. Therefore, when u-p(N-1) is an odd number, we have

$$|S[q_2, f(q_1x)/q_1]| = \begin{cases} 2^{(l+1)/2} = 2, & \text{When } l=1 \\ 0, & l > 1 \end{cases} \qquad \text{(II-7)}$$

*3 In reference [10], p 183, Theorem 7.

We substitute the results of equations (II-2) - (II-7) into equation (II-1). When $\beta = pN^2/q$, $(p,q) = 1$, $(p,q) = 1$, let $q=2^{\ell}q_1$, q_1 is an odd number, thus we have:

$$|G\Delta_s(-\alpha)|_{s=0}=\begin{cases}\frac{1}{\sqrt{qT}}\sum_{i=-\infty}^{\infty}\sum_{u=0}^{q-1}\delta\left[\alpha-\left(i+\frac{u}{q}\right)N\right], & \text{If } \ell=0,\ q=q_1\\ \frac{1}{\sqrt{q/2\,T}}\sum_{i=-\infty}^{\infty}\sum_{u=1,3,5,\ldots}^{q-1}\delta\left[\alpha-\left(i+\frac{u}{q}\right)N\right], & \text{If } \ell=1,\ N \text{ is an odd number}\\ & \text{Or } \ell>1,\ N \text{ is an even number}\\ \frac{1}{\sqrt{q/2\,T}}\sum_{i=-\infty}^{\infty}\sum_{u=0,2,4,\ldots}^{q-2}\delta\left[\alpha-\left(i+\frac{u}{q}\right)N\right], & \text{If } \ell=1,\ N \text{ is an even number}\\ & \text{Or } \ell>1,\ N \text{ is an odd number}\end{cases} \quad \text{(II-8)}$$

In the equation, f has already been normalized to α, and F_T should be normalized to N.

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CHINA'S BIG WEATHER BALLOONS PERFORM VARIETY OF SCIENTIFIC CHORES

Beijing BEIJING WANBAO in Chinese 23 Sep 81 p 2

[Article: "China's High-Altitude Weather Balloons"]

[Text] At mid-day of 12 September, a shimmering object floated through the sky over Beijing, drifting slowly from east to west and evoking wide-spread curiosity among the city's residents. Was it a "UFO"? No, it was a 30,000-cubic-meter (as big as an 80-meter-high, 14-story highrise apartment building) high-altitude scientific research balloon launched by the Chinese Academy of Sciences and related units. Its altitude was 34,000 meters as it floated some 40 kilometers south of Beijing.

Today, high-altitude scientific research balloons are the crucial tools China needs to conduct experiments and observations dealing with stratospheric and mid-atmospheric physics, high-energy physics, cosmic ray and high-altitude physics, infrared astronomy, sun-earth space physics and remote sensing. In recent years, many countries with advanced space sciences have made much use of these balloons to conduct observations and research. They are more cost-effective than either satellites or aircraft and are more flexible for conducting experiments and convenient; they are now an integral part of the organic make-up of space sciences.

China's high-altitude scientific experiment balloons consist of the following main components: The balloon itself (1), the recovery chute (2), the suspended gondola (3), and the signal equipment (4). The bag is made of high-quality polyethylene film to withstand the buffeting encountered at high altitudes and temperatures of -70 degrees. At the same time, after being filled with hydrogen, it must carry a payload into the upper atmosphere, supporting the entire load. The gondola (usually in excess of 100 kilograms) is packed with various instruments and equipment--it may be considered a kind of airborne floating observatory or "control station," to be used as a link between the surface of the earth and the sky, conducting probes of the atmosphere and space. It carries out orders from the ground control center--a part of the key link of balloon technology. The beacon equipment is special purpose gear to help fix the position of the gondola during recovery. After the separation of the gondola from the gasbag, the recovery chute brakes the descent, assuring a safe landing for the instrument package. In addition, the interior of the gondola is provided with protective layers to keep the instruments aboard from being damaged when the gondola makes its landing. A radio sounding device is provided along with cut-off devices and other auxiliary equipment.

High-altitude balloon engineering and technology are in their initial stages in China and to date, although there are only several dozen balloons for different experimental requirements, already certain probe data have been collected. We believe that in the not-too-distant future these balloons will shoulder greater roles in production, national defense, scientific experiments and other scientific endeavors and that there will be many more high-altitude balloons drifting in the vast skies of north China.

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APPLIED SCIENCES

MILITARY TECHNOLOGY TRANSFERRED TO CIVILIAN USE

Problems, Tasks

Beijing GUANGMING RIBAO in Chinese 22 Jan 82 p 1

[Article by commentator of this paper: "Do The Work of Transferring Military Technology to Civilian Use Well"]

[Text] In developing the national economy, especially during the period of economic readjustment, we must emphasize and exert efforts to transfer the technology of the military industry to civilian use well so that it can actively serve the national economy and we can coordinate the development of national defense and economic buildup.

For the past 2 years, leading comrades and scientific and technical personnel of the national defense scientific and technological sector have begun to emphasize this work that benefits both the military and the civilian sectors, and they have obtained definite results and accumulated some experience. But, at present, the form of transfer of the technology of the military industry to civilian use is still limited to the production of civilian consumer goods by military factories, frequently "competing with the civilian factories," and the technical superiority of the military factory system cannot be developed. We believe there is even more important work that needs to be done. For example, first, we must use some advanced scientific technologies of the military industry system to serve the national economy according to the plan and step by step. These technologies include aviation, nuclear energy, telemetry, remote control, remote sensing, automatic control, high strength heat resistant structural materials, etc. Second, we must fully develop the use of the specialized testing facilities of the military industrial system, such as wind tunnels, vibration environment facilities, radiation environment facilities, overload environment facilities, so that they can serve civilian units. Third, we must gradually popularize and apply the experience gained in the development and management of large systems of the military to large scale projects in economic construction. Fourth, we must develop the potential of the intellectual resources of some specific specialities in the military to provide counseling service for civilian enterprises. In addition, it is not a matter of simply transferring from the "military" to the "civilian" sector; there are many facets of civilian technology, especially production technology, which must also be

transferred to military production. The two are mutually interchangeable and develop together.

In transferring military industrial technology to civilian use, we believe the following three problems amust be solved. First, the technology must be suitable. Military industrial technology, especially some advanced pioneer technologies, when popularized and applied in the civilian sectors, cannot simply be copied. There is a process of transplanting and reorganizing. Certain scientific and technical forces must be invested. Second, the cost must be reduced. This is a key problem in transferring military industrial technology to civilian use at present. Technology with too high a cost does not have any competitiveness in the civilian market. It must be suitable, and it must be inexpensive. Therefore, we cannot just "compete" with certain "hot items" on the domestic market. The military and civilian sectors must cooperate to continue to develop new products suitable for marketing, and we must open up international markets. Third, we must handle the relationship between exchange and secrecy well. We should say, there are only a very small number of technologies that belong strictly to military technology and that are national secrets which cannot be applied in the civilian sector. Whether in the military or the civilian sector, it is necessary to carry out full internal exchange and cooperate extensively. National secrets must also be safeguarded within a definite scope. The problem of mutual concealment of technology because of competition must be gradually solved through compensatory technological transfer, technological and economic contracts, and establishment of patent laws and policies and legal measures.

The transfer of military industrial technology to civilian use must also emphasize the transfer of scientific and technical abilities and the flow of scientific and technical talent. The common experience of some advanced regions that have used scientific techniques to stimulate the economy and that have implemented technical transfer is treasuring talent and allowing each to develop his own talent. Within the scope of the whole nation, the structure of scientific and technical teams should be readjusted gradually and in an organized manner according to plan during the course of economic readjustment and readjustment of science and technology. But at present, it is unsuitable and not possible to advocate "free movement" of talent. Talent needs to move about, but talent cannot be allowed to move freely. This is a difficulty. The only effective way to overcome this difficulty is to allow a "directional flow of knowledge." The so-called "directional flow of knowledge," simply speaking, is to absorb and "borrow" various scientific and technical capabilities and knowledge from other regions, other units, and society to contribute towards developing a locality's science, technology, and economy and to develop one's own unit within a definite period with purpose, with organization, and with leadership according to the specific needs of one's own region, own department, own profession, own unit, without involving personnel reorganization and population movement. The departments and units of the national economy can select the best and the needed, and concentrate and organize various forces in joint ventures to promote the transfer of science and technology, to fill the deficiency of talent through "directional flow of knowledge." "Directional flow of knowledge" has been proven in practice to suit the civilian population and it should be suitable

between the military and the civilian sectors under definite conditions. It is also beneficial to promoting the transfer of military industry technology to civilian use. Its organization can be in many forms. For example: civilian units can invite scientific and technical experts of the military sector to serve concurrently as advisors. Concerned departments can organize scientific and technical personnel in the military to lecture and send them on academic leave for short periods to civilian units. Exchange of technology between the military and the civilian sector can be strengthened. Scientific and technical exchange activities should be launched. A mutually fitting relationship of mutual learning and mutual help should be established. The boundary line between the military and the civilian sectors must be broken. A joint venture of scientific research-production-utilization as a "whole" and as "one chain" can be organized, etc. In this way, we must carry out several practical and feasible policy measures, for example: cooperation between the military and the civilian sectors, financial management of joint ventures (source of capital, share of investment, distribution of profits), rational rules on living expenses, benefits and salary of guest experts, etc.

To transfer military industrial technology well, we must strengthen organization and leadership. There must be corresponding organizations and agencies to serve as channels for the transfer of military industrial technology. All of the scientific research units of the "military" and "civilian" sectors and the leadership at each level and the science and technology management departments must strengthen mutual contact, cooperate extremely, exert efforts to coordinate the development of national defense and economic build-up and jointly serve the development of the national economy.

Remote Technology Transferred

Beijing GUANGMING RIBAO in Chinese 22 Jan 82 p 1

[Article by Song Guangli [1345 1684 4409] and Xu Jiuwu [1776 0046 2976]: "National Defense Scientific Research Sector Emphasizes the Transfer of Military Technology, The Three Technologies of Telemetry, Remote Control and Remote Sensing Are Popularized in Civilian Sectors and Results Have Been Achieved"]

[Text] The scientific research units subordinate to the National Defense scientific research sector have emphasized the transfer of military technology. They have transplanted and popularized the three technologies (of telemetry, remote control, remote sensing) used in the products of the military industry among civilian sectors and preliminary achievements have been realized. This was learned at the national industrial telemetry and remote control conference held not long ago in Beijing. The conference was sponsored by the special committee on telemetry, remote control, and remote sensing of the China Automation Society.

To adapt to the needs of readjusting the national economy, national defense research units took the initiative to readjust the direction of their work with the prerequisite that they complete their military scientific research tasks first. Then they went to every sector of the national economy to

conduct broad and in-depth investigations and studies, utilized such measures as cooperative efforts, technological exchange and direct research and development of new products to hasten the progress of transferring the techniques of telemetry, remote control and remote sensing to civilian use. At present, these have already been applied in industry, agriculture, medicine, physical education, urban public services, and they have shown a broad future for application.

In industry, a certain research institute of the national defense science research sector used telemetry and remote control techniques in oil exploitation to help Dagang Oil Field establish a monitoring and control system. The operator only has to issue orders from the control consol at the central station to automatically control the operations of oil extraction, transportation and adding water in the oil wells. Also, the amount of extraction of oil and such parameters as temperature and pressure in the oil wells can be accurately calculated any time, and thus the modernized management level of the oil field has been iproved.

In medical treatment and public health, a certain research institute used telemetric techniques to monitor and protect the heart, and test produced a 6-channel telemetric heart beat monitor and protector. The patient only has to wear two button-sized electrodes and a microscopic emitter and his electrocardiogram will be clearly shown on the screen at the monitoring and protection center via radio transmission. When the heart beat is abnormal, the monitor can also sound an alarm signal. Preliminary trial use shows this instrument can simultaneously monitor tachycardia, bradycardia, arrhythmia, arrest of ventricular activities of the heart and premature ventricular waves of the heart of sick patients in real time.

In physical education, a certain research institute and the Physical Education Science Research Institute of the National Physical Education Committee developed a telemetric system to measure electrical activity of the muscles of athletes. This has contributed to the improvement of the level of training in our nation's physical education and sports. How to find the critical fatigue stage of an athlete is a key link in training. For a long time, because of a lack of advanced equipment, this work has always relied on the experience of the trainer and the judgment of some instruments. After using the telemetric system to measure the electrical activity of the muscles, the athlete only has to wear a sensor and an emitter which are as large as the finger nails on his body. The electrical signals of the muscles of each part of the body can be shown on the screen of an oscilloscope via radio transmission. This has provided scientific reference for accurately judging whether the athlete's physical qualities are being developed normally, the state of fatigue and recovery of the muscles, variation of nerve functions, and the best time for exerting force and intensity. The famous high jump athlete and trainer Ni Zhiqin [0242 1807 2953] personally used this instrument to conduct experiments and expressed satisfaction over the results of testing.

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COMPUTER SIMULATION OF INTEGRATED CIRCUITS DESCRIBED

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, 1982 pp 2-6

[Article by Ruan Gang [7086 0474]: "Computer Simulation Models for Integrated Circuits"]

[Text] Computer simulation of integrated circuits is an important step in achieving complete computer-assisted design of integrated circuits. A number of foreign companies and universities are engaged in this research; among them the SUPREM (Stanford University Circuit Engineering Model) program developed by the Integrated Circuit Laboratory of Stanford University is relatively well-known.[1-3] This program is a computer simulation of the most typical IC manufacture technology and it is a rather powerful program. The program takes the IC manufacture conditions as the input and provides output such as the one-dimensional distribution of impurity in silicon and parameters such as junction depth, thin film resistance, and threshold voltage of the MOS transistor. It can simulate a one-step as well as a multi-step manufacturing process, and it can also simulate the entire engineering procedure of a complete circuit. It simulates the distribution of B, P, As, Sb and Al impurities in Si and SiO_2, ion implantation, gaseous and solid chemical predeposition of the surface, driven diffusion, oxidation, epitaxy, erosion, and oxide deposition at low temperature. The format of the input parameters is simple and straightforward; the impurity distribution output may be displayed in graphic form and the minimum depth interval can be 100 A in tabulated output.

In China, the LSI laboratory of Fudan University has modified the IBM0-03 version of the SUPREM-2 program and transferred it to the NEC ACOS-4S/300 system imported from Japan by the Shanghai Foreign Trade Bureau. The modified version is known as the NEC FD 01 version of SUPREM-2. In this article we shall describe the models used in the SUPREM-2 program.

Ion Implantation Model

1. Simple Symmetric Gaussian Distribution

The simple symmetric Gaussian distribution is a crude model for impurity implantation in IC manufacturing, but the execution of this simple model is

retained in the SUPREM program. Based on user provided implantation parameters R_p, σ_p and implant quantity Q, the program does a simple symmetric Gaussian distribution.

In computing R_p and σ_p in the LSS theory, it is assumed that the bulk concentration N(y) of the implanted impurity follows a simple symmetric Gaussian distribution

$$N(y)=\frac{N_s}{\sqrt{2\pi}\sigma_p}\exp\left[-\frac{1}{2}\left(\frac{y-R_p}{\sigma_p}\right)^2\right] \qquad (1)$$

where N_s is the total impurity in units of atoms/cm^2. The implant quantity Q is related to N_s by the following equation

$$Q=\int_0^\infty N(y)dy=\frac{N_s}{\sqrt{2\pi}\sigma_p}\int_0^\infty \exp\left[-\frac{1}{2}\left(\frac{y-R_p}{\sigma_p}\right)^2\right]dy \qquad (2)$$

Let P_y be the peak concentration, then we have

$$P_y=\frac{N_s}{\sqrt{2\pi}\sigma_p}=Q\Big/\int_0^\infty \exp\left[-\frac{1}{2}\left(\frac{y-R_p}{\sigma_p}\right)^2\right]dy \qquad (3)$$

$$N(y)=P_y\exp\left[-\frac{1}{2}\left(\frac{y-R_p}{\sigma_p}\right)^2\right] \qquad (4)$$

From known values of R_p, σ_p and Q, N(y) can be computed according to equations (3) and (4).

2. Two Connected Half Gaussian Distributions

When the user supplies the energy and quantity of implantation and the element being implanted is As or P, then the program carries out the modeling of two connected half Gaussian distributions. The two half Gaussian distributions have their own standard deviations σ_1 and σ_2 (with respect to R_m). R_m is known as the model range (also known as the form range or the connection moment). Figure 1 shows schematically the two connected half Gaussian distributions. When the concentration of the implanted impurity ions on the two sides are $N_1(y)$ and $N_2(y)$ respectively, then,

$$N_1(y)=P_y\exp[-(y-R_m)^2/2\sigma_1^2] \quad 0\leq y\leq R_m \qquad (5)$$

$$N_2(y)=P_y\exp[-(y-R_m)^2/2\sigma_2^2] \quad R_m<y\leq\infty \qquad (6)$$

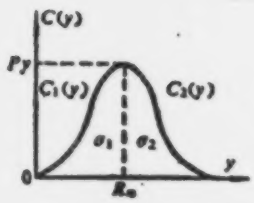

Fig. 1. Two connected half Gaussian distributions.

where P_y is related to the quantity Q of implanted ions by the following equation

$$P_y = Q/[Q(\sigma_1, R_m, 0, R_m) + Q(\sigma_2, R_m, R_m, \infty)] \qquad (7)$$

and $Q(\sigma, R, a, b)$ is the implanted ion quantity normalized by P_y.

$$Q(\sigma, R, a, b) = \int_a^b \exp[-(y-R)^2/2\sigma^2]\,dy \qquad (8)$$

In SUPREM-2, parameters σ_1, σ_2 and R_m are determined from the known implantation energy by looking up the table and by interpolation.

3. Modified Pearson IV Distribution Model

When boron ions are being implanted, the program executes the modified Pearson IV distribution model based on user supplied implantation energy and dosage.

It has been pointed out that the distribution of the implanted boron in amorphous silicon before annealing may be described by the standard Pearson IV distribution model. Formulas for the standard Pearson IV distribution model are

$$N(y) = N_0 e^{f(y)} \qquad (9)$$

$$f(y) = \frac{1}{2b_2}\ln|b_0 + b_1 X_n + b_2 X_n^2| - \frac{(b_1/b_2 + 2a)}{(4b_2b_0 - b_1^2)^{1/2}}\tan^{-1}\left[\frac{2b_2 X_n + b_1}{(4b_2b_0 - b_1^2)^{1/2}}\right] \qquad (10)$$

Parameters in equation (10) can be expressed as follows

$$\left.\begin{aligned} X_s &= (y - R_p)/\sigma, \\ a &= -\gamma_1(\beta_1 + 3)/A \\ b_0 &= -(4\beta_1 - 3\gamma_1^2)/A \\ b_1 &= a \\ b_2 &= -(2\beta_1 - 3\gamma_1^2 - 6)/A \end{aligned}\right\} \qquad (11)$$

In equation (11),

$$A = 10\beta_1 - 12\gamma_1^2 - 18 \qquad (12)$$

N_o in equation (9) can be found from the equation below

$$N_s = Q/\int e^{f(y)}\,dy \qquad (13)$$

It can be seen from equations (9) to (13) that the standard Pearson IV distribution is determined by σ_p, R_p, γ_1, β_1 and Q.

Figure 2 shows the experimental data of implanted boron distribution and computed curves of the Pearson IV distribution model. As shown in the illustration, there is good agreement between Pearson IV distribution and the experimentally obtained boron distribution from the surface to slightly over the distribution peak. There is considerable deviation from the Pearson IV distribution in describing the tail. Experimentally measured tail distribution is exponential, and the exponential tail distribution is produced by random scattering of the boron ions in the direction of the channel. In order to describe the experimental results more closely, the authors of SUPREM-2 used an empirically modified Pearson IV distribution model. In this model an exponential tail is added to the standard Pearson IV distribution, and a fixed characteristic length (0.045 micrometer) independent of dopant energy and crystallographic orientation is chosen. The exponential tail is attached to the shoulder of the standard Pearson IV distribution at the point where the concentration has dropped to 50 percent of the peak value. After attaching the tail, the distribution of the implanted ion dosage must be renormalized. The modified Pearson IV distribution agrees very well with the typical experimental result, as shown in Figure 2.

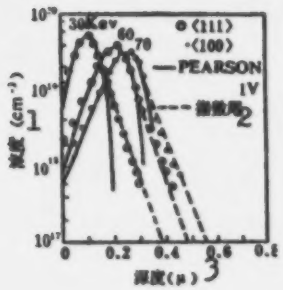

Fig. 2. Asymmetric distribution of implanted boron ion in arbitrary direction in 111 and 100 Si.
Dosage is $10^{13}cm^{-2}$.

Key: 1. Concentration
2. Exponential tail
3. Depth

4. Range Correction in the Presence of SiO_2 Layer on Si Surface

Since the stopping powers of Si and SiO_2 are slightly different, the model range R_m in the connected half Gaussian distribution and the average projection range R_p in the modified Pearson IV distribution should both be corrected when a layer of SiO_2 exists on the Si surface—the so-called SiO_2-Si dual substrate. In the SUPREM-2 program, the following two equations are used for this correction

$$R'_{msi} = R_{msi} + (1 - R_{msi}/R_{mox})Z_{ox} \quad (14)$$

$$R'_{psi} = R_{psi} + (1 - R_{psi}/R_{pox})Z_{ox} \quad (15)$$

In equation (14) R_{msi} and R_{mox} are respectively the model ranges for a single Si substrate and for impurity implantation in SiO_2. R'_{msi} represents the model range of implanting impurity into the SiO_2-Si dual substrate, i.e., the corrected model range or the effective model range. Similarly, in equation (15) R_{psi} and R_{pox} are respectively the average projection ranges of implanting impurity into a single 51 substrate and into SiO_2 and R'_{psi} represents the average projection range of impurity implantation in the SiO_2-Si dual substrate, i.e., the corrected average projection range or the effective average projection range. Z_{ox} is the thickness of the SiO_2 layer.

Impurity Mobility During Annealing

1. Diffusion Flow Model

At any given point P, the diffusion flow of impurity $F_D(y)$ is described by Fick's first law as the gradient of the product of diffusivity and concentration at that point

$$F_D(y) = -\frac{d}{dy}[D(y) \cdot C(y)] \qquad (16)$$

where D(y) is the coefficient of diffusion of the impurity. Under the assumption of diffusing as a single state, there is no generation or loss in the material and the on-dimensional continuity equation, i.e., the conservation equation can be written as

$$\frac{dQ(y_1, y_2)}{dt} = -[F_D(y_2) - F_D(y_1)] \qquad (17)$$

For homogeneous diffusion, Fick's second law may be obtained by substituting (17) and (19) into (20) and differentiating with respect to y

$$\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial y^2} \qquad (18)$$

In general Fick's second law holds for low impurity concentration. When impurity concentration is equal to or greater than the intrinsic carrier concentration $n_i(T)$ in the semiconductor at annealing temperature T, Fick's second law is no longer applicable. Figure 3 shows the relationship between n_i and temperature T; it is used as the Quesheng [4972 4164] value of $n_i(T)$ in SUPREM-2. In addition, when other high concentration impurities are present in silicon, equation (18) is not applicable for the diffusing impurity even at low concentration. We shall use the term intrinsic silicon when all the impurity concentrations in silicon are lower than $n_i(T)$ at annealing temperature T and the term nonintrinsic silicon when concentrations are higher than $n_i(T)$ of silicon at annealing temperature T.

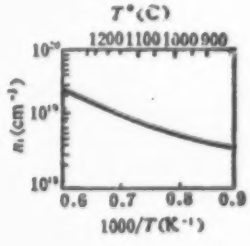

Fig. 3. Temperature dependence of intrinsic carrier concentration n_i in silicon.

Diffusion coefficient for nonintrinsic silicon. For most impurities the diffusion coefficient in nonintrinsic silicon is approximately 10 to 20 times greater than that in intrinsic silicon. It is generally believed that diffusion in nonintrinsic silicon is a result of the interaction between impurity and charged point defects in silicon. Except phosphorous, we assume the diffusivity of the impurity atom is determined only by neutral and singly charged defect state

$$D = D_i(1+\beta f_v)/(1+\beta) \qquad (19)$$

where D_i is the observable intrinsic diffusivity, $f_v = n/n_i$ (for donors) and $f_v = n_i/n$ (for acceptors). Under the intrinsic condition, $f_v = 1$ and $D = D_i$. For the nonintrinsic condition

$$D^x = D_i \frac{1}{1+\beta}, \quad D^v = D_i \frac{\beta}{1+\beta} \qquad (20)$$

where $\beta = D^v/D^x$ is the ratio of the diffusivity D^v due to charged vacancy and the diffusivity D^x due to neutral vacancy. Figure 4 shows the relationship between normalized diffusivity D/D^i and f_v. Recommended values of β (also the Quesheng value used in SUPREM-2) are 3 for boron, 100 for arsenic, and phosphorus is described by a completely different model. The β value for other impurities is not yet known and is taken to be 1.

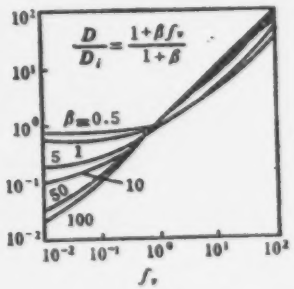

Fig. 4. Normalized diffusivity as a function of normalized carrier concentration for different β values.

Effects of other high concentration impurities on diffusion. When different impurity atoms exist in silicon, they interact with each other. Figure 5 shows the calculated effect of high concentration on the distribution of boron. In SUPREM-2 the modeling of this interaction is directly through the computation of equation (19). In the example of Figure 5, the decrease of boron diffusion in the heavily doped region is because f_v (boron) = $\frac{n_i}{n} \rightarrow 0$. Outside the boundary of As distribution, the drop of boron distribution is due to the rapid spatial variation of boron diffusivity.

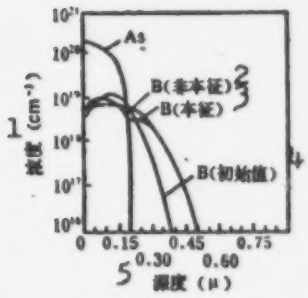

Fig. 5. Interpretation of the effect of high concentration As on the redistribution of boron.

Key: 1. Concentration
2. Nonintrinsic
3. Intrinsic
4. Initial value
5. Depth

Model of phosphorus diffusion. SUPREM-2 uses the phosphorus diffusive mobility model[4] proposed by Fair and Tsai in 1977. In bipolar transistor technology, a cusp-shaped P distribution curve and base propagation were observed in the diffusion of the heavily doped emitter region. In this model, it is believed that these "irregular" effects are due to the increase in vacancy concentration in silicon arising from the dissociation of phosphorus flowing from the surface into the bulk and the charge vacancy pairs. A typical distribution of high concentration phosphorus is shown in Figure 6.

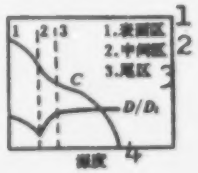

Fig. 6. Typical distribution of phosphorus impurity and diffusivity according to the model of Fair and Tsai.

Key:
1. Surface region
2. Intermediate region
3. Tail region
4. Depth

In the surface region, the diffusion of phosphorus is assumed to be due to the interaction of phosphorus and the neutral or paired charge vacancies in forming $P^+V^=$. The diffusivity in this region is given by

$$D = f_s[D^x + D^=(n/n_i)^2] \quad (21)$$

where n is free electron concentration and can be computed from the relation[5] between total phosphorus concentration C and free electron concentration n

$$C = n + 2.04 \times 10^{-41} n^3 \quad (22)$$

From (21) and (22), diffusivity in this region decreases monotonically as shown in Figure 6. The end of the surface region is assumed to be located at the point where the Fermi level has dropped to 0.11 eV below the bottom of the conduction band, or at the energy level of the doubly ionized vacancy state. Here the electron concentration n_e is given by

$$n_e(T) = 4.65 \times 10^{21} \exp(-0.39\text{eV}/KT) \quad (23)$$

In the tail region the diffusivity is strengthened with respect to the intrinsic diffusivity. This is because the dissociation of $P^+V^=$ leads to a supersaturation of vacancies in the silicon point lattice. Diffusivity in the tail region is given by the following empirical equation:

$$D_{TAIL} = f_s\left\{ D^x + D^= \frac{n_s^2}{n_e^2 n_i}\left[1 + \exp\left(\frac{0.3\text{eV}}{KT}\right)\right]\right\} \quad (24)$$

where n_s is the surface electron concentration. As can be seen from equation (24), the tail diffusivity depends strongly on the surface concentration of phosphorus. After the model predicted supersaturation of vacancy defects in the bulk, it was later proven that, under the region of high phosphorus surface concentration, any other impurity element in the silicon point lattice also shows diffusivity enhancement, roughly equal to the enhancement in phosphorus. In SUPREM-2, the enhancement factor f_{enh} is computed with the following equation

$$f_{enh} = D_{TAIL}/f_s D^x \quad (25)$$

In the presence of phosphorus, the diffusivity of any other impurity is obtained by multiplying the corresponding f_{enh} and the intrinsic diffusivity D^x of that impurity. The model handled in this manner explains the base propagation effect and predicts the diffusivity enhancement of other elements (for example, As or Sb that can form a buried collector region in the manufacture of bipolar transistors); this point has been verified experimentally.

In the case of heavy doping, an intermediate region is observed between the surface and the tail region and diffusivity in the intermediate region increases with $(n_i/n)^2$. In SUPREM-2, this empirical rule is used in the

determination of tne beginning of the tail region. The diffusivity computed at the end of the surface region where $n = n_e$ is multiplied by $(n_i/n)^2$, which increases with depth, and the beginning of the tail region corresponds to the depth at which the diffusivity has increased to D_{tail}.

From equation (24), the phosphorus diffusivity in the tail region increases monotonically with increasing surface concentration. But the tail diffusivity actually decreases when surface concentration exceeds $3\sim4 \times 10^{20}$ cm^{-3}. This may be attributed to the narrowing of the bandgap due to stress on the point lattice introduced by the high phosphorus concentration. In SUPREM-2 this stress effect is described by an increase in the intransic carrier concentration n_i:

$$n_i = n_i \text{ (stress free) } \exp(-\Delta E_g/KT) \qquad (26)$$

Here Δ Eg is the bandgap narrowing due to stress, given by

$$\Delta E_g = -1.5\times10^{-21}(C_{TS} - 3\times10^{20}cm^{-3})eV \qquad (27)$$

In equation (27), C_{TS} is the total surface concentration of phosphorus. Of course, n_e must be increased by the same amount as well. Figure 7 shows the computed phosphorus distribution with and without ΔE_g. This result demonstrated the importance of the stress consideration.

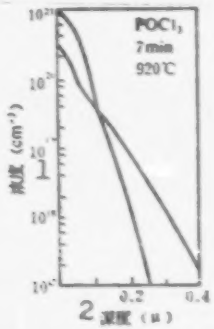

Fig. 7. Two different computed surface concentration of phosphorus distributions. The stress model of silicon leads to a slower diffusion for the higher surface concentration distribution.

Key:
1. Concentration
2. Depth

SUPREM-2 also takes into account an additional stress effect that influences the diffusion of implanted phosphorus distribution. At high doses, a further

reduction of the diffusivity is observed, possibly due to the permanent randomness of the point matrix generated in the process of ion implantation. For ion implanted phosphorus, the additional bandgap narrowing can be computed from the following equation:

$$\Delta E_g = -2.3\times10^{-8}(Q_p)^{1/3}\ \text{eV} \qquad (28)$$

where Q_p is the dosage of phosphorus atom.

2. Oxidation Enhanced Diffusion

The diffusion of boron and phosphorus is enhanced when the surface of silicon is oxidized. This phenomenon of oxidation enhanced diffusion (OED) is generally attributed to an increase of point defects in silicon due to oxidation. Hu[6] proposed a model that relates OED to the growth of OSF (oxidation stacking fault). For boron in silicon in an oxidizing environment SUPREM-2 assumes a temperature dependent and time independent OED. For phosphorus in a dry oxygen environment a fixed enhancement factor of 1.8 is assumed and the value is assumed to be 3.3 for the case of wet oxygen. Moreover, temperature and time dependent OED has been observed for other common impurities in silicon.

3. Interface Flow

Although the chemical reaction actually taking place at the interface is not very well understood, the flow of the impurity atoms through the interface can usually be described by a first order dynamics model:

$$F_s = h(C_1 - C_2/m_{eg}) \qquad (29)$$

where F_s is dopant flow, taken to be positive when the flow is from region 1 to 2, C_1 and C_2 are respectively the impurity concentrations on the region 1 side and on the region 2 side at the interface. Figure 8 depicts an SiO_2/Si interface. m_{eg} is the equilibrium segregation coefficient in region $1\sim2$ of the impurity under discussion. The definition of m_{eg} is

$$m_{eg} = C_{1e}/C_{2e} \qquad (30)$$

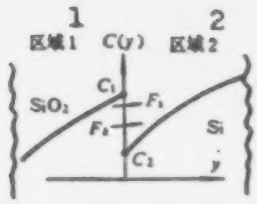

Fig. 8. SiO_2/Si interface.

Key:
1. Region 1
2. Region 2

In equation (30), C_{10} and C_{20} are respectively the equilibrium impurity concentration on the region 1 side and on the region 2 side of the interface. The factor h in (29) is the surface mass transfer coefficient and has the units of velocity.

For a moving interface there is also a motion-induced interface flow caused by unequal impurity concentration. This flow F_b is represented by

$$F_b = -V_{ox}(C_1 - \alpha C_1) \qquad (31)$$

where $V_{ox} = dZ_{ox}/dt$ is the oxidation growth rate, α is the ratio of oxidized silicon thickness to the oxide layer thickness (equal to 0.44). Generally F_b and F_s compete with each other. When $h \gg V_{ox}$, then $C_2 \rightarrow m_{eg}C_1$ and equilibrium segregation dominates. In SUPREM-2, h is arbitrarily chosen to be 0.1 μm/min and $h \gg V_{ox}$ is obviously satisfied.

4. Generation and Loss Mechanism--Model of Arsenic Diffusion

Almost all the impurity dopants can exist in silicon in more than one state, especially at high concentration. A typical situation is that one state is interstitial and mobile and the other state is some form of precipitant or cluster and immobile. The exchange between these two states can be described by the generation and loss term in the mobile impurity continuity equation (16). SUPREM-2 includes a model for the clustering of arsenic. Due to the lack of a suitable model, the effects of clustering and precipitation on the migration of other atoms are ignored. The chemical reaction for arsenic is assumed to be

$$mAs \underset{K_d}{\overset{K_c}{\rightleftharpoons}} As_m \qquad (32)$$

where m is number of atoms in the cluster, K_c and K_d are respectively the rate constants for clustering and for declustering. The concentration of atomic clusters is defined as

$$C_c = C_T - C \qquad (33)$$

where C_T is the total concentration, C is the interstitial concentration and the conservation equation of C_c is

$$\frac{\partial C_c}{\partial t} = mK_c C^m - K_d C_c = l - g \qquad (34)$$

where l and g are respectively the loss term and the generation term in (16). Equilibrium cluster coefficient K_e is defined as

$$K_e = \left(\frac{K_c}{K_d}\right)^{1/m} \qquad (35)$$

Equation (34) can be rewritten as

$$\frac{\partial C_c}{\partial t} = K_d[m(K_e C)^m - C_c] = l - g \qquad (36)$$

Equation (36) is used to describe the thermal diffusion of atoms in silicon. The value m = 4 is most consistent with recently observed results. The declustering rate is taken to be that proposed by Schwenker et al[6]. Under equilibrium (i.e., $\partial C_c/\partial t = 0$) and for m = 4, equation (36) becomes

$$\frac{C_T}{C} = 1 + 4K_e^4 C^3 \qquad (37)$$

Figure 9 is a graphic display of equation (37). As can be seen, clustering limits the maximum concentration of interstitials, and this limiting effect is a function of annealing temperature

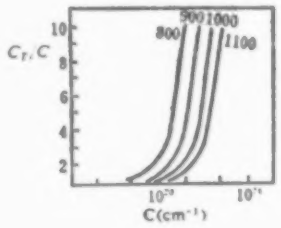

Fig. 9. Normalized total As concentration as a function of interstitial As concentration at different temperatures under equilibrium. Curves are obtained from the cluster model.

Thermal Oxidation

In SUPREM-2 the rate of growth of SiO_2 on Si is given by the familiar equation

$$Z_{ox}^2 + AZ_{ox} = B(t+\tau) \qquad (38)$$

where Z_{ox} is the thickness of the oxide layer, t is time, and A and B are related to the linear growth coefficient K_L, the parabolic growth coefficient K_p and the normalized O_2 partial pressure P_{O_2}

$$A = P_{O_2} K_p / K_L \qquad (39)$$

$$B = P_{O_2} K_p \qquad (40)$$

Parameter τ depends on the initial oxide layer thickness,

$$\tau = \frac{Z_{ox}^2(t=0) + A Z_{ox}(t=0)}{B} \qquad (41)$$

At low dopant concentration K_L and K_p are only dependent upon the crystal orientation of Si and the oxidation atmosphere and they are simple activation functions of temperature.

The oxidation rate of Si increases at high surface concentration regions such as the drain and the source of MOST and the emitter of bipolar transistors. It was discovered by Ho et al[7] that the linear rate coefficient indicative of the surface reaction rate increases substantially and the parabolic rate coefficient indicative of the O_2 diffusion through SiO_2 only increases moderately. These increases slow down as temperature increases. SUPREM-2 uses the model of Ho and Plummer in the quantitative description of the relationship between the enhancement of K_L and K_p and the surface dopant concentration. The basic concept here is that the oxidation rate of Si depends on the concentration of lattice vacancy, which in turn is closely related to the concentration of dopant atom, as we have discussed in the diffusion flow model.

According th this model, the linear rate coefficient can be written as

$$K_L = K_L^i [1 + \gamma (C^T - 1)] \qquad (42)$$

where K_L^i is the intrinsic (i.e., low concentration) linear rate coefficient and γ_L is an experimentally determined parameter, given by

$$\gamma = 2.62 \times 10^3 \exp\left[-\frac{1.10\text{eV}}{KT}\right] \qquad (43)$$

Here C^T is the normalized total concentration of vacancy, given by

$$C^T = \frac{1 + C^+\left(\frac{n}{n_i}\right) + C^-\left(\frac{n}{n_i}\right) + C^=\left(\frac{n}{n_i}\right)^2}{1 + C^+ + C^- + C^=} \qquad (44)$$

where

$$C^+ = \exp[(E^+ - E_i)/KT],\ E^+ = 0.35\text{eV}$$

$$C^- = \exp[(E_i - E^-)/KT],\ E^- = E_g - 0.57\text{eV}$$

$$C^= = \exp[(2E_i - E^- - E^=)/KT],\ E^= = E_g - 0.11\text{eV}$$

From the expressions of the normalized intrinsic concentrations of vacancies in three different charge states, we can see that each charged state of the vacancy has its corresponding energy state in the silicon bandgap. The temperature dependence of the bandgap E_g and intrinsic energy level E_i are

$$E_g(T) = 1.17 - 4.73\times10^{-4}[T^2/(T+636)]\text{eV} \quad (45)$$

$$E_i(T) = E_g/2 - KT/4 \quad (46)$$

For the n type dopant, the enhancement of the parabolic oxidation rate is given by

$$K_p = K_p^i(1+\delta C_T^{2.22}) \quad (47)$$

where

$$\delta = 9.63\times10^{-16}\exp\frac{2.83}{KT}\text{eV} \quad (48)$$

K_p^i is the intrinsic parabolic rate and C_T is the total atomic concentration of the n type dopant.

Because of the distribution of the diffusion and segregation, the surface concentration of the impurity changes during oxidation and the enhancement of K_L and K_p are usually time dependent. For this reason, SUPREM-2 does not use the classical oxide growth equation

$$\Delta Z_{ox} = [\frac{1}{} - (2Z_{ox}+A) + \sqrt{2(Z_{ox}+A)^2+4B\Delta t} \quad (49)$$

where Δt is a small time increment. When the simulation time is chosen to be within Δt, due to the redistribution of impurities in silicon, the values of A and B are obtained from the surface impurity concentration in each Δt and the corresponding increment in oxide thickness ΔZ_{ox} is obtained from these A and B values.

Silicon Epitaxy

The epitaxial growth model used in SUPREM-2 is shown in Figure 10.

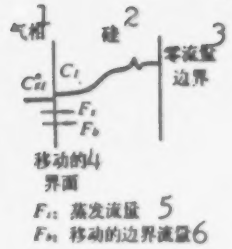

Fig. 10. Impurity redistribution model for epitaxial growth of Si.

Key:

1. Gas phase
2. Silicon
3. Zero flow interface
4. Mobile interface
5. Evaporation flow
6. Mobile interface flow

It is assumed that the gas in the container has a single uniform dopant of an equivalent concentration C^*_{gI} (a fictitious concentration equal to the dopant concentration necessary for uniform epitaxy). The actual situation of the gas phase is not considered in SUPREM-2. Figure 10 shows that there are two flows F_b and F_d at the solid-gas interface. F_s is the "evaporation" flow

$$F_s = h(KC^*_{I0} - C_I) \qquad (50)$$

where h is the evaporation coefficient of the impurity, as mentioned in the discussion on interface flow. We shall define that, except for the joining of the interface by direct movement, all impurity flows between the solid phase and the gaseous phase are evaporation flows. C_I is the impurity concentration at the solid surface and K is the surface equilibrium segregation coefficient, defined by

$$K = C_{I0}/C^*_{I0} \qquad (51)$$

where C^*_{gI0} and C_{I0} are respectively the gaseous phase surface impurity concentration and the solid surface impurity concentration at equilibrium.

The term F_b represents the flow due to interface movement, similar to the oxidation situation, F_b is given by

$$F_b = V(C^*_{I0} - C_I) \qquad (52)$$

where V is the boundary velocity (growth rate).

The calculation of diffusion flow of impurities in the solid has already been discussed earlier.

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PROBLEMS IN SEMICONDUCTOR STORAGE DESIGN DISCUSSED

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, 1982 pp 7-11

[Article by Zhang Wujian [1728 0523 0256] of the Sichuan Electronic Equipment Company: "Some Considerations in Designing Semiconductor Storage Systems"]

[Text] Introduction

Beginning in the mid-1970's, along with the rapid development of the semiconductor integrated circuit, semiconductor storage has gradually become the main technique for large computers in foreign countries. In China, due to the limitations in the development of the semiconductor industry, this innovation process in storage technology was delayed by about 5 years. Semiconductor storage has had a profound impact on the performance-price ratio, software design, versatility of terminal facility and microcomputer application. Semiconductor storage has the advantages of a high degree of integration, low power consumption, small volume, and convenience in usage and maintenance and is gradually replacing magnetic core storage. How to adapt to this technological change and how to design and develop storage systems with attractive performance-price ratios based on the characteristics of semiconductor storage are important issues before us.

From the viewpoint of storage system development, semiconductor storage has the following features:

1. Test Patterns Are Complex

Semiconductor storages are highly integrated; the storage unit, driver, decoder and readout amplification circuits are all on the same chip, so it is pattern sensitive. In order to test the functions of semiconductor storage effectively, several tens of test patterns have been designed. To this end, testing equipment capable of checking a multitude of patterns must be developed, and considerable time will be needed to complete a total functional test. Therefore, the testing cost (including labor) is a significant portion of the development cost of the entire semiconductor system.

2. Peripheral Circuit of the System Is Correspondingly Simple

The semiconductor storage itself already has some driving, decoding and readout amplification ability--the new 64K dynamic MOS RAM even has refresh control on the same chip--and the further development of "intelligent storage" even gives the storage device computational and control ability. This makes the peripheral circuits of the system correspondingly simple: ordinary integrated logic circuits can be used.

3. High Density Assembly Can Be Easily Realized

Both the semiconductor storage and the peripheral circuit are assembled from components. Therefore, system assembly can be simplified to rational division of plug-in boards and layout of these boards. This has not only simplified the technical design but has also made high density assembly easy to realize.

When compared with the magnetic core storage system, semiconductor storage also has the advantage of a short development period.

Some Considerations in Designing Semiconductor Storage Systems

1. Organization Methods

Along with meeting demands for higher speed and greater capacity of the computer main storage, the development of the main storage structure goes from single storage to multiple storage. The emergence of semiconductor storage has provided favorable conditions for a multiple storage system. In a multi-storage system, there are three basic organization configurations (see Figure 1): (1) Multiple storage time-shared access-in this configuration, all the storage units share the same input and output interface and main line; it is suited for the case where the processor is required to do batched high-speed retrieval of numbers. In order to resolve the dilemma of high-speed access of the processor and the storage period, a number of buffer registers are installed in the input-output interface, thereby prolonging the number-retrieval time of the random access. Its advantage is the high utilization rate of peripheral interface circuitry and the high rate of signal transmission on the main line. (2) Multiple storage real-time access--here each storage has its own input and output interface and main line; this scheme is suited for the case where a number of processors and request sources are accessing the mainframe storage. It reduces the random access time of number retrieval from the main storage, but it requires a large number of interfaces and main lines and the design of the storage control network is also relatively complicated. (3) Multiple storage, hybrid access--each storage operates in a real-time access mode, but each storage unit is subdivided into a number of modules which operate in a time-shared mode. This scheme is a compromise: it not only satisfies the requirement of multiple request sources having simultaneous access to the main storage but also improves the rate of signal transmission on the main line and the utilization rate of the interface circuitry and eases the cycle time pressure on the main storage.

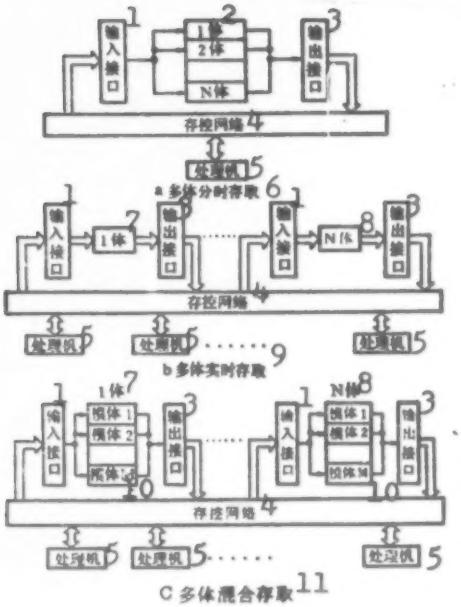

Fig. 1. Organization of multiple storage.

Key:

1. Input interface
2. Storage 1, storage 2..... storage N
3. Output interface
4. Storage and control network
5. Processor
6. Multiple storage time-shared access
7. Storage 1
8. Storage N
9. Multiple storage real-time access
10. Module 1, module 2 ..... module M
11. Multiple storage hybrid access

The method of storage organization should be chosen based on the overall requirement of the computer system. We opted for the multiple storage hybrid access mode with a main storage capacity of 2048K x 40 bit (including 8 Hamming correction bits), divided into 16 storage units (plus 2 spares) controlled by 2 storage and control networks. Each storage is further divided into 4 modules with 32K words, each operating in a time-shared mode. The main storage cycle is 400 ns; therefore, the maximum signal transmission rate of the main storage is $64/400 \times 10^{-9}$ = 160 mega words/second.

2. Choosing a Storage Device

The primary consideration in choosing a storage device is rational selection of the type of device and its performance specifications. In general, there are three types of storage devices (refering to RAM) in computer systems: low-capacity high-speed buffer storage; large-capacity main storage; and exclusive storage for external facility, channel, and terminals. The design of the computer system specifies the capacity and speed requirements of the high-speed buffer storage and the main storage; their speed ratio is usually 1:5$\sim$10 and their capacity ratio is at least 1:10. It is therefore appropriate to use high-speed bipolar RAM for high-speed buffer and large-capacity dynamic MOS RAM for main storage. Special component storages should be chosen according to the needs, and preference should be given to static MOS RAM because of their low power consumption; refresh control can be avoided. In our design we chose 1K ECL bipolar RAM to provide 16K x 40 bit high-speed buffer storage and 16K dynamic MOS RAM to provide our main storage of 2048K x 40 bit total capacity. Because static MOS was not available, we used 4K dynamic MOS RAM to provide 4K x 8 bit storage for the display device and simplified the refresh control by having refresh implicitly contained in the duty cycle. The second consideration is universality and expandability of the lead-out wires and different supply source. At present, 4K, 16K and 64K dynamic MOS RAM in foreign countries all have compatible leads, and components can be readily interchanged to expand the capacity by four times. The third question is an economic one, that is, the optimum performance-price ratio. Whether to adopt devices of a higher degree of integration can only be decided after an overall evaluation of the cost per bit and the cost of testing and assembly. The fourth consideration is stability and reliability of device production. It is best to select products that have undergone 1 or 2 years of production and are being supplied to users in volume. Test procedures and reliability test data should be obtained from the manufacturer whenever possible.

3. Designing the Peripheral Circuitry

1) Choosing the Type of Peripheral Logic Circuitry

Except for ECL bipolar RAM, the input and output voltages of most RAM devices are TTL voltage. Hence, TTL components should be chosen for the peripheral logic circuit of the storage system to avoid the voltage conversion problem. But sometimes ECL logic circuits are also used to reduce the time for address decoding, clock transmission and data correction in cases where the system requires rapid number retrieval from storage. For example, in the design of the main storage, considering that the system requires the storage to output a number in less than 240 ns (including Hamming check), which is not possible with TTL logic, and considering that the mainframe already uses ECL logic components, we opted for the MECL 10K series devices. In the storage for the 4K x 8 bit display, we used a TTL peripheral logic circuit which has the same voltage as the interface to external devices.

2) Choosing a Driver

Since the chip selector and address line of all the RAMs in the storage matrix are connected in parallel, it puts a large load demand on the front stage driver. For MOS RAM devices, the input terminal has a high impedance and the input current is in the microampere range; hence the load requirement for the front stage driver is primarily the ability to drive a large capacity load. We used a MC10177E-NMOS as the driver which has a maximum capacity load of 350PF. Considering stray capacitance of the circuit and maintaining a safety factor, the design allows each driver to drive no more than 16 MOS RAMs. The storage matrix of the display has only 8 MOS RAMs, so the two input terminals and the passive gate (DEG14C) of TTL will suffice.

3) Designing the Timing Sequence Circuit

The time sequence circuitry has an important effect on the reliability of the storage system. Accurate and versatile timing is an important criterion for high-speed operation of the storage system and maximum supply capacity. There are different methods for designing the time sequence circuit; Table 1 lists the five principle methods.

In view of the simple time sequence and the short delay time of the ECL bipolar RAM, we used a delay line for the time sequence circuit in our design of the high-speed buffer storage. In the MOS storage exclusive to the display, although the time sequence is relatively complex, due to the slower speed and the low demand on timing acduracy, a delay line is again used. For the large capacity MOS main storage, however, a shift register is used to produce the basic pulse sequence and a delay line is added for accurate timing, because here the time sequence is relatively complicated and there are certain requirements on the accuracy and versatility of the timing. Synchronization with the mainframe clock is achieved by triggering the clock oscillator externally with the mainframe access signal.

4) Refreshing Control of the Dynamic MOS RAM

Refreshing of the dynamic MOS RAM requires the execution of a refreshing cycle of all the addresses within a certain time interval (normally 2 ms in an ambient environment at +70°C).

The distribution method of the refreshing cycle can be: concentrated refreshing, distributed refreshing or fixed refreshing, as shown in Figure 2. In concentrated refreshing, the refreshing cycles of all the addresses are executed continuously within the refreshing period. Under the worst case, the mainframe would have to wait a time equal to the line number multiplied by the refreshing period. In distributed refreshing, a refreshing cycle is executed once every refreshing interval /line number, and the mainframe waiting time is shorter. The system elasped times are the same for the

Table 1. Practical methods for time sequence circuit

方法[1]	最小脉宽[2]	最小定时改变量[3]	定时精确度[4]	定时改变灵活性[5]	评价[6]
[7]单稳电路	>20ns	[8]连续可变	[9]对电源温度变化敏感	[10]灵活	[11]线路简单。适用于脉宽较大、定时精确度要求不高的场合。
[12]延迟线	[13]取决于信号波形及延迟线抽头	[14]取决于延迟线抽头	[15]电源变化影响传输信号波形	[16]改接延迟线抽头或调节延迟线长度	[17]延迟线要仔细匹配，波形整形。适用于时序较简单的场合。
[18]计数器加译码器	[19]取决于时钟频率	[20]取决于时钟频率	[21]取决于时钟频率稳定度	[22]改接译码器引出头	[23]电路较复杂，采用器件较多，要和主机时钟同步。适于时序较复杂而变动较少的场合。
[24]移位寄存器	[25]同上	[26]同上	[27]同上	[28]改接寄存器输出头	[29]同上
[30]可控PROM	[31]取决于PROM最坏取数时间及时钟频率	[32]同左	[33]同上	[34]改变PROM内容	[35]电路复杂，采用器件较多，要和主机时钟同步。适于时序要求复杂且灵活改动的场合。

Key:

1. Method
2. Minimum pulse width
3. Minimum timing change
4. Accuracy
5. Versatility
6. Evaluation
7. Monostable circuit
8. Continuous variable
9. Sensitive to temperature change of the power supply
10. Versatile
11. Circuit is simple. Suitable for cases where pulse width is large and timing accuracy requirement is not high
12. Delay line
13. Depends on signal waveform and delay line tap
14. Depends on delay line tap
15. Changes in power supply affect transmitted waveform
16. Alter delay line tap or adjust delay line length
17. Delay line must be carefully matched and waveform carefully shaped. Suitable for simple timing sequence

[Key continued on following page]

[Key continued]

18. Counter plus decoder
19. Depends on clock frequency
20. Depends on clock frequency
21. Depends on the stability of the clock frequency
22. Alter decoder lead-out
23. Circuitry is relatively complex and uses more components; must be synchronous with mainframe. Suitable for cases where timing sequence is relatively complex but does not have many changes
24. Shift register
25. 26. 27. Same as above
28. Alter shift register output lead
29. Same as above
30. Controllable PROM
31. Depends on the worst case of the PROM access time and the clock frequency
32. Same as the left
33. Same as above
34. Change the content of PROM
35. Circuit is complex and has many components, must be synchronous with mainframe. Suitable for cases where the timing sequence is complicated and versatile changes are required

above two methods. In fixed refreshing, the refreshing cycle is contained implicitly in the duty cycle of the storage and in this method the duty cycle period of the storage is the sum of the read/write period and the refreshing period. The choice between the three methods should be made based on the allowable waiting time of the mainframe in random accessing the storage and requirement of the duty cycle of the storage.

There are three modes of operation regarding the access request and refresh request of the processor: asynchronous refreshing, synchronous refreshing and senisynchronous refreshing (see Figure 3). In asynchronous refreshing, access request of the processor and refresh request of the storage are judged by the refresh control as two independent "events" on the basis of "first come, first serve." It requires the processor to wait when the storage is busy refreshing. In order to resolve the competition between access and refresh, the design of the refresh control would have to be more sophisticated, and the time for the storage to output a number would therefore be prolonged. The advantage is that the storage system has more independence. In synchronous refreshing, the refreshing cycle is executed when the processor is not accessing the storage. It requires the processor to have a definitive "not accessing" period and its refresh control is simpler. The fixed refreshing method described above is one form of synchronous refreshing. Semisynchronous refreshing works the same way as synchronous refreshing except that the refreshing timer is synchronized by the main clock provided by the processor. In general, the access request

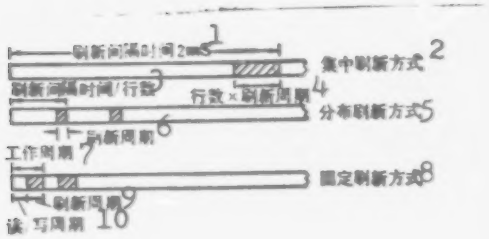

Fig. 2. Refreshing cycle distribution of dynamic MOS RAM system.

Key:

1. Refreshing interval 2 ms
2. Concentrated refreshing
3. Refreshing time interval/line number
4. Line number x refreshing cycle period
5. Distributed refreshing
6. Refreshing period
7. Duty cycle
8. Fixed refreshing
9. Refreshing cycle period
10. Read/write cycle

is generated during the ascending edge of the main clock, and the descending edge of the main clock is used to synchronize the refreshing timer, thereby avoiding the "competition" problem and, also, the output time of the storage is not prolonged by the refresh control. In our MOS main storage design we used semisynchronous distributed refreshing and in the display storage we used synchronous fixed refreshing.

4. Designing the Self-Checking Circuit

In order to carry out effective checks and tests of the storage system, self-checking circuits must be designed. This should include time sequence and control, address generator, data pattern generator, readout comparator, error recorder and display panel. Because of the intrinsic sensitivity to pattern of semiconductor storage devices, the self-checking circuit is rather complex. There are three self-checking circuit designs:

1) Hardwired Assembly Logic

Based on the necessary data pattern and regularities of address change, a control flow chart is first made. It is then reduced to a truth table and simplified into control logic equations by Boolean algebra, and finally engineering designs are made. Assembly logic suffers very little transmission delay, and the self-checking circuit based on it can produce high-speed changes in the address and data pattern. However, the logic design

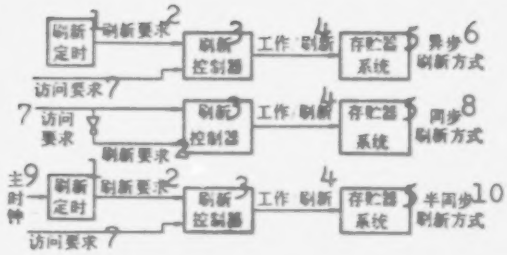

Fig. 3. Refreshing synchronization operation of dynamic MOS RAM system

Key:

1. Refreshing timer
2. Refresh request
3. Refresh control
4. Busy/refresh
5. Storage system
6. Asynchronous refreshing
7. Access request
8. Synchronous refreshing
9. Main clock
10. Semisynchronous refreshing

of this type of self-checking circuit is complicated, requires more components, and once it is finalized the testing pattern is fixed and lacks versatility. It is suitable for testing high-speed bipolar storage systems where the testing pattern is already fixed.

2) Microprogram Controlled Self-Checking Circuit

Using a microprogram address counter, microcommand storage addresses are produced. The microcommands are read out and address change, data pattern and R/W control of the storage system being tested are generated. Microprogram transfer address and control microprogram address count are also produced based on the signal according to the corresponding digit of the microcommand. The advantages are versatile test pattern (by changing the content of the PROM), simple logic design, fewer components and convenience of use and maintenance. However, its operating frequency is affected by the PROM readout time and the transmission time in the microprogram counter.

3) Microprocessor Controlled Self-Checking Circuit

The basic method is the same as the microprogram controlled self-checking circuit; the difference is that its address generator, data pattern generator and pattern comparator are all operated with microprocessors. Its advantages

are more versatile pattern testing and address changing for more convenient multidigit data pattern comparison, fewer components and simple hardware logic design. However, the operating speed is limited by the speed of the microprocessor, word length of the microcommand storage is longer, the design of microprogram is more complex, and design and maintenance personnel must be familiar with the use of microprocessors.

Each of the three schemes described above has its own advantages, disadvantages and adaptability, but they all require a certain amount of hardware. From the system economy viewpoint, they are used only in large-capacity multiple storage systems so that self-check and maintenance can be carried out for various storage units whenever desired. In our design, a microprocessor controlled self-checking circuit is installed for every eight storages in the MOS main memory; for high-speed buffer storage, no on-line self-checking circuits are included.

5. Division of Plug-in Circuit Board

Plug-in storage is an important part of semiconductor storage systems and it requires a matrix layout. The division of plug-in depends primarily on the structure of the storage matrix and secondarily on the consideration of less connection lines between plug-ins and clear logic division. We included the following considerations in our design:

1) The basic storage matrix is 4 x 8 and the plug-in dimensions are determined on this basis.

2) Except for the storage matrix and the necessary driving circuit and output interface circuit, no other logic circuits are installed on the plug-in storage board. The plug-in storage is modularized for more convenient combination and expansion of the capacity and word length.

3) We have carefully compared and optimized the number of modules, capacity and word length of a given plug-in storage. Table 2 lists the various plans of a MOS main storage plug-in. We opted for the 2 x 32K x 8 bit structure because it uses fewer components, has the minimum number of lead-out lines, and the 8 bit character length is convenient for parity check and malfunction diagnosis according to bytes.

Measures To Improve the Reliability of Semiconductor Storage System

The reliability of the semiconductor storage system is the combined result of a number of factors, including reliability of the semiconductor storage device and the peripheral logic circuitry, rigorousness of component testing and screening, wiring layout of the plug-in board and chassis, quality control of the production, calibration technique and the fault tolerance of the system design. Some of the problems are beyond the ability of the storage worker. In the space below we shall describe only the measures taken in storage system design.

Table 2

模体数×容量×字长 [1]	存贮器件数 [2]	驱动器件数 [3]	插件板功耗 [4]	输出接口器件数 [5]	信号引出线数 [6]
4×32K×4位 [7]	32	16	24.4瓦 [8]	1	100
2×32K×8位 [7]	32	10	18.5瓦 [8]	2	68
1×32K×16位 [7]	32	0	18.1瓦 [8]	4	70

Key:

1. Module number x capacity x word length
2. Number of storages
3. Number of drivers
4. Power consumption of plug-in
5. Number of output interfaces
6. Number of signal leads
7. Bit
8. Watt

1. Rigorous Testing and Screening and Systematic Checking

Rigorous testing and screening and systematic checking are crucial steps in insuring the reliability of storage systems. Not only D.C. characteristics and performance and dynamic characteristics should be tested, but separate tests should be made on the three stages of component, plug-in board and system. In the meantime, effects of ambient temperature and power source drift should also be taken into account. Figure 4 is a flow chart of the testing.

1) Inspect all components upon arrival and conduct aging tests. Using a static parameter testing station, test all D.C. parameters. Perform six pattern tests ("1" and "0" scan, walk, jump, jump and recovery, neighbor interference and calibration board) at a function testing station. A power supply pulling test should be carried out for both the above tests. The test on arrival can be carried out at room temperature only for speedy testing.

2) Storage boards are tested with a homemade semiconductor function tester. The tester has a maximum operating frequency of 20 MHz and can provide various test patterns; it has a programmable power source, and a clock can be conveniently set on the panel. Tests are conducted at the actual operating frequency of the storage, and $V_{DD}= f(V_{BB})$ operating range is found with the worst case pattern at 70°C. In addition, spot checks of high-speed dynamic characteristics testing by varying the phase clocks are conducted for the storage boards. This test not only checks all the components on the board and measures the operating range, but it also tests whether the wiring layout on the board is sensible.

3) The purpose of testing the storage system is to test the overall function of the system, to measure the operating range of the system for various patterns and to examine the reliability of the system.

4) After the storage is in on-line operation, it is again checked with the function testing program, and errors are recorded with software.

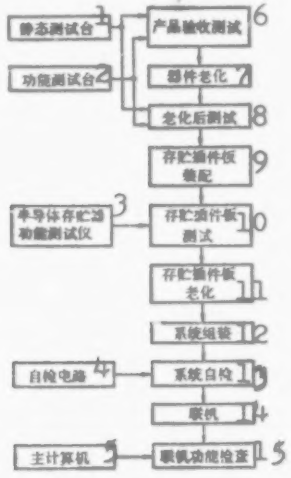

Fig. 4. Flow chart for testing semiconductor storage system.

Key:

1. Static testing station
2. Performance testing station
3. Equipment for testing the function of semiconductor storage
4. Self-checking circuit
5. Main computer
6. Product testing upon arrival
7. Component aging
8. Testing after aging
9. Assembly of storage plug-in board
10. Testing assembled storage board
11. Aging of storage plug-in
12. Assembly of system
13. Self-checking of system
14. On-line connection
15. On-line performance check

2. Rigorous Design of Storage Board Layout

The key to the engineering design of the semiconductor storage is a rational layout of the board. In contrast to a logic device, a storage device has many signal input leads that act simultaneously and coherently. When a large number of storage devices are put together to form a storage matrix, these leads are connected in parallel. Concurrent switching of signals on these parallel leads requires a high peak current from the supply and induces a large induction voltage on the leads to the supply. Furthermore, the parallel

input leads also produce a large induction voltage and oscillating waveform at the front stage driver. These effects are even more serious in large-storage matrices and high-speed storages. If these problems are not solved, they will not only place a higher demand on the dynamic load characteristics of the supply and the driver, but will also generate serious noise interference within the board. In order to solve these problems, the following measures should be taken:

1) Install distributed decoupling capacitors. The power supply system of a storage matrix is actually an inductance-resistance network (see Figure 5). L_1R_1 and L_2R_2 are respectively the equivalent inductance and resistance of the power supply main line and power leads between the RAM's. A high-frequency decoupling capacitor C_2 is installed at every supply connection of the RAM to provide most of the peak current during signal switching so that transient current fluctuation and induction voltage of the power supply can be reduced. C_1 is used for low-frequency decoupling for the entire storage matrix.

2) Use a multilayered printed circuit board. An effective method for reducing lead induction is to design a network of power supply and ground wire. Supply leads and wires should be wide so as to reduce resistive voltage drop. For dynamic MOS RAM, the order of line width should be ground, V_{DD}, V_{BB} and V_{CC}.

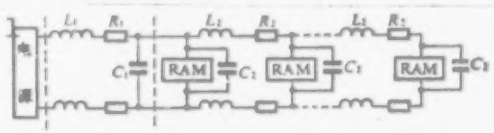

Fig. 5. Equivalent circuit of a storage matrix.

Key:
1. Power supply

3) Install damping resistor at the output terminal of the driver to smooth out the induction voltage and waveform oscillation produced by signal switching.

4) Since bipolar storages require large and stable D.C. current, they should have even wider supply and ground leads. All bipolar storages have a single power supply; this requirement is easy to satisfy.

In our layout of the MOS main storage board, we used six-layered printed board--four layers of signal leads and the other two layers, respectively, for horizontal and vertical power supply and ground leads. The dimension of the printed board is 280 x 180 mm^2. It has a 72 line plug, with 40 leads for power supply and ground, and the remainder are signal leads. A V_{DD} = +12V and V_{BB} = 5V. A 0.33 μF high-frequency decoupling capacitor is

installed for every two RAM's. At the power supply input terminal, a number of 22 μF capacitors are connected in parallel for low-frequency decoupling; V_{DD} has 16, V_{BB} has 12 and V_{CC} has 5.

3. Sensible Use of Correction and Diagnostic Techniques

For output, the Hamming code is used to correct a single error and sort out a double error. A parity check is performed on the input address and input data, and a checking circuit is installed for the control signal. After the storage is in operation on-line, the operating system software is used to record errors of the storage. This is very useful for understanding the reliable operation of the storage system and for diagnosis and maintenance.

For high-speed buffer, since the Hamming code occupies peripheral time of the storage and affects the readout speed, a choice must be made after weighing the plus and minus of speed and reliability.

4. Installation of Redundant Units

In cases where high reliability is demanded, redundant units can be installed. When an error appears in a certain storage and cannot be corrected, the operating system can automatically switch a redundant unit into operation and the malfunctioning unit is then self-checked, fixed and used as a spare.

Suggestions on the Modularization and Standardization of Semiconductor Storage Systems

Semiconductor storages are easy to modularize and standardize. In China, an early solution to this problem before semiconductor storages are extensively in use in computers will aid the rapid development of semiconductor storage systems.

1. Serialization of Storage Devices

In the development of semiconductor storages in China, we should draw on foreign experience; conduct extensive surveys on the application situation of semiconductor storage devices in China, the customer needs, and the level and characteristics of Chinese semiconductor storage technology; and produce quality products (including circuit structure, characteristics parameter, lead arrangement, external dimension and testing codes) to gradually form a series for the user's choice.

2. Modularization of Storage Matrix

Concerning the question of arranging storage matrices on a board, we recommend 4 x 8 or 4 x 9 storage devices as the basic storage matrix module. They are favorable for word expansion, adaptable to the load of driver, and the board dimension is also suitable.

3. Standardization of Board Dimension

We recommend the establishment of several standard board dimensions and structural formats based on the basic storage matrix module, including the number of layers of the printed board, arrangement of the power supply lead-in wires, the number of lead-out wires and external profile and dimension, coupled with the corresponding standard plugs (single and double plugs). This is not only favorable to the modularization and standardization of storage devices but also conducive to the gradual unification and compatibility of computers.

4. Simplification of Self-Checking Circuits

In large-capacity multiple storage systems, it is necessary to install a self-checking circuit that is complete, versatile and has sophisticated logic. For mass-produced medium- and small-capacity modularized storage, however, a complicated self-checking circuit will increase the cost and the difficulty of service and is not favorable to the modularization and standardization of the storage device. An alternative is to conduct all function testing with comprehensive semiconductor storage testing equipment when the storage modules come off the machine, and provide only a simple self-checking circuit inside the storage system.

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CSO: 4008/72

FREQUENCY SYNTHESIZER APPLIED TO LASER TECHNOLOGY

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese
No 1, 198? pp 33, 11

[Article by Zhong Deyuan [6945 1795 0337], Wu Longbiao [0702 7893 2871] and Yu Guanhe [0151 0385 0735] of the China University of Science and Technology: "Laser Application of Frequency Synthesizer"]

[Text] The frequency synthesizer described in this paper has been successfully used to mode-lock two lasers. From this practice we have realized the following: 1) The variable frequency signal source allows a lower dimension tolerance of the modulator, reduces machining time and cost, and improves the acceptance rate of the product. In the meantime, there is no need to change the signal source when the modulator is changed. 2) It facilitates the investigation and measurement of modulator parameters such as the optimum frequency and power rating of the modulator. This provides a method for designing a high-performance modulator and operating the modulator in its optimum condition. 3) It makes the tuning of a laser modulator more convenient and operation more stable. In the initial tuning or in the retuning after temperature change, mode locking can be readily achieved by adjusting the modulation frequency and the cavity length. Since the modulation frequency is highly stable, the operation is also stable. We therefore believe the frequency synthesizer is an important component of the actively mode-locked laser, and other signal sources cannot compare.

1. Requirements

Center frequency: 50 MHz, tunable range 50 ± 1 MHz, frequency jump step 1 KHz, output power is tunable with a maximum value of 3 watts, frequency stability better than 10^{-7}/sec.

2. Method

Based on the above requirements, we designed the synthesizer shown in Figure 1. The 5 MHz output signal from the high-stability crystal oscillator is divided by 50 and 500 and then given respectively 100 KHz and 10 KHz square waves and these become the reference signal for the $49 \sim 50.999$ MHz phase locked loop

and the 1.00～1.99 MHz phase locked loop. The 1.00～1.99 MHz VCO uses an integration monostable circuit in producing 1.00～1.99 MHz square waves, which are then added to the variable frequency divider and the decade frequency divider. The frequency division ratio of the variable frequency divider is in the range of 100～199 so the frequency after division is 10 KHz and the frequency step is also 10 KHz. This 10 KHz square wave signal and the 10 KHz reference signal are discriminated in a current type phase discriminator, the error signal after the discriminator is returned to control the frequency of the VCO and forms a phase locked loop. The other output signal of the VCO is divided by a decade frequency divider and added to the current type phase discriminator of the 45.100～45.199 MHz phase locked loop. The other signal to the discriminator is a 45 MHz sine wave signal produced by a 5 MHz signal going through a 9 x frequency doubler. This sine signal is mixed with a 45.100～45.199 MHz signal, coming from the output of an LC push-pull negative resistance voltage controlled oscillator, in a balanced mixer to get the difference frequency. After filtering, amplification and shaping, the output is a 100-199 KHz square wave signal. The two equal frequency 100～199 KHz signals are discriminated in a discriminator and the error signal is returned to control the VCO and forms the second phase locked loop. Since the output signal of the phase locked loop is fed through a decade frequency divider and used as the reference signal for the second phase locked loop, therefore the frequency of the output signal from the second phase locked loop is 45.000～45.199 MHz with a frequency interval of 1 KHz and a variation range of 100 KHz. This signal is added to the balanced mixer of the third phase locked loop with the 49.000～50.999 MHz signal from the VCO; the difference frequency is filtered, amplified and shaped to form a 3.9-5.8 MHz square wave and fed into a 39～58 times variable frequency divider. The output from the variable

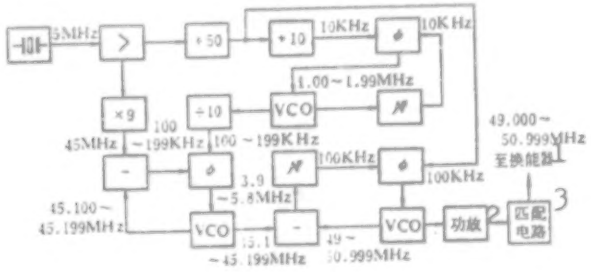

Fig. 1.

Key:

1. To transducer
2. Power amplifier
3. Matching circuit

frequency divider is a fixed 100 KHz square wave; it is processed in a current type phase discriminator with a 100 KHz reference signal. The error signal from the discriminator is used to control the LC push-pull negative resistance voltage controlled oscillator in forming the third phase locked loop. The other output of the VCO goes through a variable attenuator and a power amplifier and is fed into an impedance matching circuit so that there is sufficient power to drive the transducer in the electricity-sound conversion.

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CSO: 4008/72

MINERAL PROCESSING PROGRESS OF METALLIC ORES

Beijing YOUSE JINSHU [NONFERROUS METALS] in English No 1, 1982 pp 36-37

[Article by Shi Daxin [4258 1129 2450] (Senior Engineer of Beijing Mining and Metallurgical Research Institute)]

[Summary] China is known for its richness in metallic ore resources with almost all varieties, having a long history of mining activities. Throughput has been constantly increasing, while technology improving.

Despite of the raw ore grade decreasing, recoveries of main metals have been raising and kinds as well as the output of by-products expanding. The present paper describes the progress in grinding, classification and in the beneficiation of tungsten, tin, complex sulphides, copper, molybdenum, nickel, precious metals and iron ores.

GRINDING AND CLASSIFICATION Autogenous and semi-autogenous mills have been increasingly used, especially in iron concentrators. In some plants, magnetic pulleies are used to discard wastes from autogenous mill discharges. Comparing with ball mills, the consumption of grinding media has been reduced by 40% in plant using rod-pebble mills. The fine screening with rappers has been widely adopted in magnetite plants for upgrading concentrates. In some plants, hydrocyclones have been replaced by F. S. R. unites as classifiers.

TUNGSTEN AND TIN Although multistage grinding and gravity separation are mainly applied to the beneficiation of such ores, combined flowsheets of gravity, magnetic separstion and flotation are also used. In the treatment of ore slimes, gravity method with centifugal separators for roughing followed by vanners for cleaning is successfully adopted; flotation and combined processes of gravity separation and flotation have been increasingly used; rock-shaking vanners are also introduced. Progress, in the concentration of tungsten ore slime, has been made by way of high intensity magnetic separation followed by flotation. The methods of cleaning rougher concentrates comprise gravity, magnetic, electrostatic separation, table flotation and flotation as well as combined processes of beneficiation and metallurgy. Some concentrators treating refractory cassiterite ores produce, in addition to final tin concentrates, low grade semi-products for further treatment with special metallurgical processes.

COMPLEX SULPHIDES In respect of the methods of separation, many a cyanide-free and dichromate-free separation methods have been developed, resulting in improvements of separation efficiency; reduction of environmental pollution and increasing recovery of precious metals; and solution of the problems associated with separation

of some complex sulphide ores, containing a large amount of secondary copper minerals. In addition, the electroflotation technique has been introduced in a lead-zinc concentrator, resulting in saving regulators and depressors. As concerns the flotation flowsheet, "equi-flotability" has been widely used.

COPPER A number of effective flotation reagents have been utilized. Flotation columns have been used for more than 20 years, and a new type annular-ejecting flotation machine has also been put into operation. With respect to the recovery of refractory oxidized ores, both the single stage segregation with direct heating and the leaching-extraction-electrowinning processes are in operation. Some other methods have also been investigated with better results, such as, pressure ammoniacal leaching, pressure ammoniacal leaching with sulphur precipitation-flotation, pressure sulphidization-flotation and leaching-precipitation-carrier flotation.

MOLYBDENUM, NICKEL AND PRECIOUS METALS The flotation flowsheet of molybdenite trends towards open circuit, i. e. discarding final tailings in cleaning stages. Furthermore, some concentrators also produce middlings for further treatment with hydrometallurgy. Heavier wax and combined collectors are adopted in some concentrators, improving molybdenum recoveries.

In a certain plant dealing with difficult nickel ores, flotation-desliming-magnetic separation-flotation flowsheet has been used instead of single flotation. Recovering cobalt alloy from converter slags and separating richer precious metal alloy from nickel matt with ore dressing methods have been put into practice.

Extracting gold with thiourea has been investigated in commercial scale test with better results achieved. Recovering precious metals from anode slime and leaching residues by means of flotation has also been carried into effect.

IRON In order to better metallurgical performances of some hematite ores, a number of promising means have been found out. The magnetic separation-gravity separation process (spiral chutes for coarser fraction, and centrifugal separators for finer one) has been gone on stream. The magnetic separation-high intensity magnetic separation -weakly acid flotation has also been in operation. For treating fine grain iron ores, the selective flocculation-desliming process employing ammonium humic acid as a flocculant has been tested commercially with satisfying result. Another experiment using the same process and sodium silicate to promote selective flocculation for a complex iron ore has also been conducted successfully in pilot scale test.

In order to recovering ilmenite from tailings of a magnetic concentrator, a plant adopting gravity-high tension separation process (Humphrey spirals for coarser fraction and spiral chutes for finer one) has been set up. Through trial production the concentrate assaying 46–48% TiO_2 has been produced.

CSO: 4010/2

OPERATION, PRODUCTS OF SHANGHAI SMELTER DESCRIBED

Beijing YOUSE JINSHU [NONFERROUS METALS] in English No 1, 1982 pp 82-84

[Article by Liu Yaozhong [0491 5069 0022]

[Text] **Liu Yaozhong**, *a deputy chief engineer, is a fellow of the Academic Committee of Heavy Metal Metallurgy, attached to the Chinese Society of Metals and a member of the Council of Shanghai Metal Association.*

After graduation from Zhejiang University in 1950, he successively held posts of the director of the central lab and the deputy chief engineer of the Shanghai Smelter. With great diligence and conscientiosness, Liu Yaozhong has been working in the fields of heavy metal metallurgy and germanium and silicon as semiconductor materials for over thirty years. He has made some contributions to the Smelter in the development of its production, the improvement of its technological process as well as the management of the Smelter.

Shanghai Smelter, located in the City of Shanghai—— the largest industrial base which has lots of transport facilities and railways leading to all parts of our country, is one of the non-ferrous metallurgical plants of the People's Republic of China. The Shanghai Seaport is also well-known in the world, which can berth in the harbour ocean-going ships from different countries.

Shanghai Smelter is an old plant. Before 1949, on a small scale, it could only produce single product of 410-ton electrolytic copper, using cupric coin as raw materials. And it had only 197 employees altogether.

Since the founding of the People's Republic of China in 1949, the Smelter has made rapid strides as a result of the performance of our National Economy Programme. For example, last year it produced 65,000 tons of electrolytic copper, 70,000 tons of wire bar and other 50 varieties of products. Now the Smelter has 10 sections, which are scattered in several districts of this city.

The Smelter has a capacity of producing base, precious and rare metals, chemical compounds, semiconductor material, brass strips, electrolytic copper foil, metals of high purity. The quality of most products has reached an advanced level, as compared with the same ones in the world.

The Smelter is supplied with the blister copper as raw material partly from Anhui and Hubei Provinces of our country,partly imported from Peru, Zambia and Chile.And

there are large quantities of waste materials being used, such as, scraps of copper, lead, nickel alloy, cobalt alloy, germanium as well as precious metals-containing scraps. As potential power of processing those scraps is available in our Smelter, we hope that we could get those scrap materials from abroad.

Now, the Smelter is able to produce six varieties of products which are as follows:

1. **Heavy metals**——copper, wire bar, nickel, cobalt, lead, bismuth and Babit alloy.

2. **Precious metals, rare metals, high purity metals and compounds**——gold, silver, platinum, palladium. Some metals are of 99.99% purity, those are tin, lead, indium, selenium aud tellurium.

3. **Semiconductor materials**——germanium ingot, zone-melting germanium ingot, germanium single crystal and wafer, monocrystalline silicon, zinc selenide and lead telluride.

4. **Compouds**——copper sulfate, nickel sulfate, cobalt sulfate, cobalt acetate, stannous chloride, sodium stannate, litharge (lead monoxide), germanium tetrachloride, zinc sulfate and zinc oxide.

5. **Strip and foil**——brass strip and eletrolytic copper foil.

6. **Other products**——selenium drum for duplicator, semiconductor refrigerator alloy, composite powder for spray plating on metallic surface.

In the Smelter, there are some small-sized mechanical devices which are designed and installed by itself. For example, the bridge-type charging machine for reverberatory furnace, startig sheet machine, anode ear-correcting and arranging machine, electrolytic copper washing and arranging machine. The labour intensiy is greatly lowered owing to these machines.

Certain amount of elements added in anode promotes the precipitation of anode slime. By mixing up complex additives into the electrolyte and by other efficient means, the current density of cathode reaches $330A/M^2$. The distance between the same electrods is 75mm, and the utilized coefficient of cell remains $146Kg/M^3$ a day. This figure is about 150% of that of the same kind of plants in the world. The purity of copper reaches 99.98%, bearing 8ppm of silver. Having controlled the oxygen and sulfur, the conductivity of wire bar with the cathode as raw material remains approximately 101.0—101.5%, which approaches the standards of the same kinds abroad. And wire bar may also be drawn into the finest wire up to 0.015 or 0.02mm in diameter. Electrolytic nickel of 99.99% purity and nickel sulphate are extracted from scraps of nickel alloy, which is one of the characteristics of the Smelter. Another feature is: by using the scrap and sweep of transistor plants, it produces germanium ingot, zone-refining ingot, single crystal and wafer by means of chemical extraction and purification, zone-melting, and vertical pulling (Czechraliki Technique), cuttiug, grinding and polishing. This kind of wafer with definite parameters can be directly used in making diodes, transistors etc. It is estimated that the Smelter will produce 7000Kg of monocrystalline germanium and 13000Kg of wafer in 1981. Also, an increase can be expected in the next year.

The properties of pin hole, resistivity, tensile strength, and stability of colours of electrolytic copper foil in rolls are close to those of the same products abroad. The thickness of foils is about 35 μ and 50μ or according to the customers, the maximum width of which is some 1060mm. The water used in making of copper foil is purified by electrolytic dialysis.

The comprehensive processing of the "three wastes", (waste residue, waste water and waste gas) is the main task in production. The large amount of the wastes has been recovered and turned into chemical compounds. That is benificial to both the Smelter and customers.

Eighteen years have passed since crystalline nickel sulfate was separated out of copper electrolyte and purified. Recently, the Smelter began its production of sodium stannate from flue dust. From scrap lead, by means of wet method, the production of litharge has begun, which is a raw material for high refractive optical glass. The impurities with colours, such as copper, iron, nickel, cobalt, chromium, manganese and vanadium are very small: 0.1 to 2ppm or less. Germanium tetrachloride used for optical-fiber is highly purified to 8N.

The anode slime from copper electrolysis is processed in a separate section to produce selenium, gold, silver, platinum and palladium. There were a lot of improvements in production facilities in recent years. The Smelter has designed and installed a rotary kiln, the sulfation and sublimation of selenium dioxide simultaneously took place in it. The charge and discharge of it went on continuously. Cupellation furnaces have become convertors instead of original fixed reverberatory furnaces. And the gas from the convertors is purified by pulse-bag filter. The collection of dust remains more than 99%.

The Smelter can produce selenium drums made of pure selenium and selenium alloy for duplicators bythe method of vacuum evaporation. Now drums of 240 and 129mm are being manufactured for duplicator factories.

In the Smelter, there is a special group which is making extensive study on several problems, such as reduction of energy consumption; research work on saving electricity, fuel oil, gas and coal. In this way the total amount of consumption of energy went down gradually year by year.

The Smelter also set up a central laboratory where there are many experienced engineers and technicians who are specially engaged in the study of technological process design of new products, environmental conservation and comprehensive utilization. The central laboratory has done a great deal in the development of the Shanghai Smelter.

CSO: 4010/1

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CSO: 4008/39

AUTHOR: ZHENG Qilun [6774 0796 0243]
HUANG Guanguang [7806 6306 0342]

ORG: Both of South China College of Engineering

TITLE: "A New Multiple-valued Logic Circuit: Application of Duoyuan Luoji (DYL) in the Development of Multiple-Valued Logic"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 6, Nov 81 pp 23-32

ABSTRACT: Although there have been advancements in the research of multiple-valued logic circuit (MV) since 1974, such as ternary CMOS and MV-I^{2}L, their realization involves engineering difficulties. This paper purports to point out that the linear AND-OR gate of Duoyuan Luoji, which is the Chinese Pinyin spelling of multiple element logic, DYL for short, created by Prof. WANG Shoujue [3769 1343 6030] of the Research Institute of Semiconductors Chinese Academy of Sciences [DIANZI XUEBAO No 2, 1978 pp 43-51 and No 1, 1980 pp 1-9] is in reality an excellent MV AND-OR gate. When it is combined with other circuits, a new type of MV, i.e. a MV-DYL circuit may be constructed. Advantages of MV-DYL are demonstrated by comparing it with ternary CMOS and MV-I^{2}L, as well as with binary DYL circuits. An analysis of the DYL circuit and the realization of basic computation in case of MV-DYL AND gate, MV-DYL OR gate, and MV-DYL THRESHOLD gate are introduced. The authors are preparing another paper on the logic design of MV-DYL, to be published in DIANZI XYEBAO soon.
This paper was received for publication in Dec 1980.

AUTHOR: WANG Wenying [3769 5113 1758]
CHEN Shuyuan [7115 0647 6678]
QIN Xiuying [4440 4423 5391]
HUANG Jinman [7806 6855 3341]

ORG: All of Beijing College of Post and Telecommunications

TITLE: "An Optimal Design Method of Constant-Delay Filter"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 6, Nov 81 pp 41-46

ABSTRACT: In order to meet the requirements of distortionless transmission of television, facsimile, and data signals, the need for designing a filter in accordance with the constant group-delay ripple tolerance occurs frequently in the engineering process. Although the method suggested by WANG Dejun [3769 1795 7165] in "Theory of Computer-aided Optimized Design of Linear Phase Filter" [BEIJING YOUDIAN XUEYUAN XUEBAO No 1, 1979] is usable, it is difficult to convert time delay ripple index to phase shift ripple index and many components are required. This paper introduces a method of starting from group delay directly, using high speed computer and the improved damping least square method to accomplish optimal approximation. Experimental design and test measurement proved the theory to be correct. The delay ripple is 30μs less and one fewer inductance component is needed, compared with the method proposed by WANG Dejun.
This paper was received for publication in Jun 1980.

AUTHOR: HUANG Dawei [7806 1129 5898]
MAO Yongjiang [5403 5057 3068]

ORG: Both of Shanghai Railway College

TITLE: "Computer-aided Design of Highpass and Lowpass Filters"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 6, Nov 81 pp 47-57

ABSTRACT: The use of the synthesis method to design filters was created by Cauer and Darlington in 1930. After the introduction of computers in the early 60's, the method was revived. If numerical place accuracy is to be maintained, a large computer must be used to execute the complex program computations in the various stages of synthesis, however. Taking into consideration the concrete condition in China, the paper proceeds to analyze the design theory of pass-band equiripple lowpass filters and point out that with some changes the technique of using transformed frequency variation (proposed by B.R.Smith in 1965 and R.W.Daniels in 1974) may also be used to design highpass filters. With this technique, long and complex numerical computation can be avoided, and the synthesis computation of a high grade filter may be accomplished in a small computer of 8-9 places of accuracy. With a program written by the authors (not given in the paper) 2 sample designs are provided. The paper explains in general terms filter design programs and a brief flow chart.
This paper was received for publication in Feb 1980.

AUTHOR: KANG Peng [1660 7720]

ORG: Changsha College of Engineering

TITLE: "Design Techniques for Reliability of DG-1 Computer"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 6, Nov 81 pp 76-81

ABSTRACT: Following a general description of the DG-1 computer system, a small fixed point machine of a word size of 24 places used mainly in process control but also in scientific computation, this paper introduces the parity check technique which is installed in all important data channels of the DG-1. The fault probability and the reliability of the dynamic configuration of the central processing unit (CPU) are analyzed. The Hamming code is adopted to check the MOS memory. Several significant experiments have demonstrated the capability of the DG-1 to work reliably in controlling random emergencies. If various accessories are added and software measures are used to improve, continuously, the dynamic configuration, the reliability of DG-1 may still be guaranteed even under the condition of relatively poor maintenance and prolonged continuous operation.
This paper was received for publication in Dec 1980.

6248
CSO: 4009/222

AUTHOR: HUANG Wenhu [7806 2429 5706]

ORG: Automatic Flight Dynamics Research Institute

TITLE: "Vibration of Some Structures with Periodic Random Parameters"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 1-16

TEXT OF ENGLISH ABSTRACT: In a periodic structural system such as blades in a closed packet of turbomachinery, the natural frequencies of the individual blade can be randomly different from one another. This paper describes a solution approach to such a periodic structure in which the distributions of blade frequencies are random processes with small standard deviations. A spectral method is suggested to solve for differential equations with random coefficients. The expressions for vibration modes are given, the standard deviations of natural frequencies are estimated, and the results of forced vibration are presented. Some special features of vibration characteristics of this system are shown as well.

AUTHOR: GU Zhenlong [7357 7201 7127]

ORG: Materials Mechanics Teaching and Research Group

TITLE: "The Tentative Model of Fracture Mechanism of Unidirectional Fiber-strengthened Composite under Tension"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 17-24

TEXT OF ENGLISH ABSTRACT: A volume element which consists of not only fiber but also the matrix around the fiber has been taken into consideration for the possibilities of tensile failure, shearing failure of matrix and interface failure. Three kinds of failure modes, i.e., basic failure, coupled failure and induced failure, are described by means of logic diagram. The corresponding expressions of reliability and failure possibility of the composite are given. Finally, the effects of length and cross section size of composite and volume ratio of fiber are discussed. The method to determine the critical stress and critical crack length is also presented.

The purpose of this paper is to get rid of the restriction of self-similar crack propagation assumption.

AUTHOR: YUAN Zhejun [5913 0772 0193]
CAO Yuliang [2580 3768 5328]

ORG: Both of the Cutting Tools Teaching and Research Group

TITLE: "New Method of Measuring Temperature Distributions with Orthogonal Metal Cutting"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 25-33

TEXT OF ENGLISH ABSTRACT: A new method of measuring temperature distributions in the cutting region is given in this paper. A thin wire of constantan (diameter 0.07 mm) is welded to the side of a workpiece as a thermocouple. With orthogonal cutting the tool passed beneath the wire, so that the wire passed up the tool face still welded to the chip. The tool passed over the wire and passed beneath the wire, and the wire-work thermocouple could possibly give the temperature field throughout the chip and the work. In this paper experimental method used by foreigners are evaluated, including the imbedded thermocouple method, the infrared photograph method, the infrared radiometric microscope method. Compared with all these methods, our new experimental method of measuring the cutting temperature field gives better results.

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 2, 1981 pp 25-33]

The temperature field in the cutting region measured by our experiment gives interesting results: 1) the isotherms in the primary deformation zone are near the shear plane; 2) the maximum temperature in the chip takes place at the point where the chip leaves the face of the tool; 3) the maximum temperature in the workpiece takes place at the point where the cutting surface leaves the tool.

AUTHOR: SUN Jingmin [1327 7231 3046]
WANG Xinrong [3769 2450 2837]
GAO Shengying [7559 5110 5391]
LIU Zifeng [0491 1311 0023]
LIU Yongli [0491 3057 0500]

ORG: SUN, WANG and GAO all of the Machine Tool Teaching and Research Group; LIU Zifeng and LIU Yongli both of the Qiqihar Machine Tool Plant No 1

TITLE: "Elements in the Beam-type of the Finite Element Method Used in the Calculation of Static and Dynamic Characteristics of Machine-tool Elements"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 34-42

TEXT OF ENGLISH ABSTRACT: In this paper, first of all we recount the defects of the calculating method which uses equivalent diameters and the advantages of the calculating method by the finite element method for elements of the beam-axle type. Then we introduce the ways of thinking and the outcomes of calculation of the program for the evaluation of static and dynamic characteristics of elements of the plat beam element. Then we give an example to illustrate the calculating peculiarities and the results of the large extension-arm with polygon-sections and slide block slipper of vertical boring and turing mills. In addition, in order to make

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 2, 1981 pp 34-42]

a comparison with the evaluated results, we also list some measured outcomes in the practice of static deformation of the slide block slipper of vertical boring and turing mills.

AUTHOR: WANG Zhongren [3769 0112 0088]
ZHU Baochuan [2612 1405 3123]
LIU Lijun [0491 4539 0689]

ORG: All of the Forging Teaching and Research Group

TITLE: "An Experimental Study of Superplastic Tin-Lead Alloy Thin-walled Tubes Subjected to Combined Stresses"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 43-54

TEXT OF ENGLISH ABSTRACT: An experimental study of superplastic tin-lead alloy thin-walled tubes subjected to axial tension compression with internal pressure is described. The main results of this study are as follows:

The actual yield stress values of the superplastic material observes the Mises yield criterion and approximately agrees with the Tresca yield criterion. Because the superplastic material is sensitive to strain rate, its yield locus, as shown in the article, expands out homogeneously with increasing strain rate. This result is given first. The results of this investigation show that the rule of correspondence between strain and stress order, given in a previous article, is correct.

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 2, 1981 pp 43-54]

In addition, the results of this investigation show that the superplastic deformation stress-strain relation observes the flow theory under the conditions of changing stress order and corresponds to the total strain theory if the stresses do not deviate far from proportionality.

AUTHOR: XU Shoulian [6079 1343 1670]
FENG Xuefei [7458 7185 7378]
WANG Dianliang [3769 0368 0081]
WEI Xiulan [7614 0208 5695]

ORG: All of the Metal Materials and Heat Treatment Teaching and Research Group

TITLE: "A Study of Strengthening and Toughening Treatments of Ultrahigh-strength Steel 37SiMnCrNiMoV"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 55-69

TEXT OF ENGLISH ABSTRACT: In this paper, effects of various heat treating processes, including conventional quenching, quenching from high austenitizing temperatures, repeated quenching, austempering, etc., on strength and fracture properties of sheet steel 37SiMnCrNiMoV were studied. Experimental results show that high temperature quenching improves the fracture toughness of the steel, but leads to the reduction of impact toughness. The repeated quenching can offer an optimum combination of strength, fracture toughness and impact properties and, therefore, seems to be the best method for developing the property potential of the material.

AUTHOR: JIA Jun [6328 0971]
ZHANG Baoshu [1728 1405 2579]
WEI Yingchang [7614 4134 2490]
YE Rongmao [5509 2837 5399]
JIANG Xiangqun [5592 7449 3123]
GAO Shucheng [7559 2579 2052]
ZHANG Shaoxiang [1728 4801 4382]

ORG: JIA, ZHANG Baoshu, WEI and YE all of the Casting Teaching and Research Group; JIANG, GAO and ZHANG Shaoxiang all of the Northeast Light Alloys Processing Plant

TITLE: "The Influence of Filter Cleaning on Fracture Toughness of an Aluminum Alloy"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 70-81

TEXT OF ENGLISH ABSTRACT: Based on the experimental results of plane strain fracture toughness and SEM fractography of the filtered and unfiltered LD_5 aluminum alloy specimens, the effect of non-metallic inclusions on the fracture toughness has been discussed. It has been shown that the fracture toughness of this aluminum alloy can notably be improved by filter cleaning and the value of K_{1C} can be increased by 12.7 percent under the conditions of these experiments. A close

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 2, 1981 pp 70-81]

relationship between K_{1C} and $\overline{\lambda}$, the average distance of non-metallic inclusions in this aluminum alloy, has been established. The K_{1C} is in direct proportion to $\overline{\lambda}^{0.44}$ and this relationship has been demonstrated by regression analysis. The experimental results conform to theoretical deduction.

AUTHOR: LIU Xinglong [0491 5281 7893]

ORG: Mathematics Teaching and Research Group

TITLE: "On the Existence and Estimation of the Mixed Generalized Partial Derivative in the Orlicz Space (I)"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 82-96

TEXT OF ENGLISH ABSTRACT: In this paper, we show that if function $f(x)$ satisfies: (1) $f(x) \in L_M^*(G)$ and the support of the function $f(x)$ strictly belongs to G, (2) for each variable $x_i (i = 1, \ldots, n)$, $f(x)$ has non-mixed generalized partial derivative $D_i^l f(x) \in L_M^*(G)$ and the support of $D_i^l f(x)$ strictly belongs to G, then the function $f(x)$ has all mixed generalized partial derivatives of order l in $L_M^*(G)$, and we also obtain the corresponding estimate. Where denoted by $L_M^*(G)$, the Orlicz space for N-function M(u) on the domain G and l is a positive integer.

AUTHOR: YANG Lemin [2799 2867 3046]
LIN Jingxian [5677 2417 6343]
TANG Youhua [3282 2589 5478]
et al.

ORG: All of the Tuning Fork Development Group, Time Specialty, Harbin Institute of Technology

TITLE: "Research of Etch Technique of Thin Quartz Oscillator"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 97-105

TEXT OF ENGLISH ABSTRACT: In this investigation, a chemical etch technique of fabricating thin quartz fork oscillators with thickness less than 0.1 mm and cut type x+5° is presented.

Using vapor chrome and gold to plate respectively on two sides of crystal ribbon polished to a mirror finish, outlines of forks and electrode lines can be etched on the two sides after applying a coat of glue. Tens to a hundred forks can be obtained on every crystal ribbon after laminated etching. Then mounting the forks and modulating the frequency, they can be used to enclose electronic watches as miniature oscillators.

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 2, 1981 pp 97-105]

The main points of the above-mentioned processing have been described briefly in the paper. In addition, the characteristics and developments of the technique have also been pointed out here.

AUTHOR: LIU Chunhe [0491 2504 0735]

ORG: Computers Teaching and Research Group

TITLE: "Minimization of Fuzzy Logic Functions"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1981 pp 106-114

TEXT OF ENGLISH ABSTRACT: Some important concepts on fuzzy logic functions are presented simply, and a table method by which the fuzzy logic functions are minimized is provided in this paper. This method is different from those presented by Kandel, Rickman, Neff and Pepe. The essential and non-essential fuzzy prime implicants can by formed together by it. Thus, some theorems can be proved conveniently.

9717
CSO: 4009/270

AUTHOR: HUANG Changxiang [7806 7022 4161]

ORG: Ironmaking Department, Chongqing Iron and Steel Company

TITLE: "The Preliminary Practice of the Operating Control with Enlarged Charge and High Blast Temperature"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 1-4

TEXT OF ENGLISH ABSTRACT: The norms of the Chongqing Iron and Steel Company include two blast furnaces, each of 620 m^3. Due to the use of low grade iron ore with large quantities of slag, low sinter ratio, frequent change of charge and improper control of the upper and lower zones, both furnaces have a long period of lower gas utilization and less production efficiency.

In the last three years they have made good progress by improving the quality of materials, production management and the operation technique. The blast temperature has been increased from 850-900°C to 1000-1068°C. This has been achieved under the conditions of low grade raw materials and not using the injection of fuel.

It is pointed out in this paper that the most important thing in blast furnace operation is to choose the proper coke charge and use a fixed blast temperature with varying humidity as a control method. The ore charge has been increased to

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18-20 tons gradually and the charging system has been changed from reverse filling (coke:ore) and semireverse filling (ore:coke:ore) into normal filling system (ore:coke). Thus the gas utilization has been increased 3-4 percent and the coke ratio has been greatly decreased.

AUTHOR: JING Dingzhong [5592 1353 0022]

ORG: Maanshan Iron and Steel Company

TITLE: "Experimental Study for Safe Injecting of Bituminous Coal into Blast Furnace"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 5-9

TEXT OF ENGLISH ABSTRACT: Injecting bituminous coal into the blast furnace is an important way of increasing the source of fuel for the blast furnace. Factors influencing spontaneous combustion and explosive properties of the bituminous coal have been studied in laboratories and safety measures in injection have also been suggested and put into practice. During the experiment operation, we analyzed the safety conditions of coal injection facilities, and measures for controlling the atmosphere, temperature and quick cutting of the coal supply under low pressure, etc., are taken. During the experiment, the operation of the furnace was quite stable and smooth and satisfactory results have been obtained.

AUTHOR: LI Wenchao [2621 2429 6389]
LIN Qin [2651 0530]
YE Wen [5509 2429]
BAO Zhongyi [0545 1350 0001]
LING Yanping [5677 3601 1627]
WANG Futian [3769 4395 3944]
JIANG Fuhua [30684395 5478]

ORG: All of the Beijing University of Iron and Steel Technology

TITLE: "The Kinetics of Different Rare-earth Additives on the Oxidation Resistance of Fe-Cr-Al Alloys"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 10-18

TEXT OF ENGLISH ABSTRACT: Under the condition that the residual content of rare earth is fixed, the kinetic effects of different rare earth additives on the oxidation resistance of Fe-Cr-Al alloys at high temperatures have been studied. The apparent energy of activation in the range of 1250-1350°C is calculated. In addition, the mechanism of oxidation is discussed preliminarily.

The structure and composition of the oxide films were examined by metallograph, petrograph, X-ray, EPMA, IMP and SEM. The mechanism of the oxidation resistance of Fe-Cr-Al alloys with different rare-earth additives is discussed.

AUTHOR: KONG Fanfen [1313 4907 5358]
RUAN Dacheng [7086 1129 3397]
CAO Hongwen [2580 3163 2429]

ORG: All of the Institute of Chemical Metallurgy, Chinese Academy of Sciences

TITLE: "Study of the Viscosity of Slag Containing Vanadium in Steelmaking"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 19-24

TEXT OF ENGLISH ABSTRACT: A study of the melting temperature, viscosity and mineral structure of the converter slag from Panzihua Iron and Steel Company and the synthetic slag indicates that V_2O_5 makes the melting temperature and the viscosity decrease obviously, and the vanadium in the slag with CaO forms calcium vanadate of a low melting point. It may be considered that V_2O_5 plays the role of diluent at the expense of the consumption of free CaO. That is why a large amount of CaO is needed during blowing to make a desulfurizing slag of high basicity. In basic slag, vanadium is found as a polyvaluent, with the 5-valuent prior to the 3-valuent vanadium in combining with CaO to form vanadate and the spinel of 3-valuent vanadium is also formed when the basicity decreases to 1.5 and the V_2O_5 increases to 20 percent.

AUTHOR: WANG Tingpu [3769 1694 3302]
LI Shengzi [2621 3932 2535]
WANG Hangwen [3769 3352 2429]
HE Jisheng [6320 4949 3932]

ORG: WANG Tingpu, LI and WANG Hangwen all of the Northeast Institute of Technology; HE of the Cold Rolling Plant, Aushan Iron and Steel Company

TITLE: "Study of Conditions of Rolling Stability and Forces Acting on the Rolls in the Unsymmetrical Rolling Process"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 25-31

TEXT OF ENGLISH ABSTRACT: In this paper through experimental study and theoretical analysis the following results are obtained:
1) With the reducing of the diameter of one roll by two-thirds, the folling pressure drops by 35-55 percent during rolling between rolls of unequal diameters (i.e., unsymmetrical rolling), greatly increasing the rolling efficiency.
2) The influence of various factors on the lateral force has been studied. The larger the angle of deviation of the smaller roll, the higher the rolling speed and the greater the amount of reduction and the greater the lateral force. The lateral force in the reverse direction rolling is much larger than that in positive direction rolling. In order to reduce the peak value of lateral force and to make it homogeneous, the diameter or speed of the upper driving roll should be properly reduced.

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3) When rolled by single driving roll in unsymmetrical rolling, the result is reverse with double driving rolls. The lateral force in positive direction rolling is much larger than that in the reverse rolling. Therefore, the smaller roll should deviate toward the entrance of the pass (in reverse rolling).
4) The simplified formulas for calculating the lateral force and the optimum amount of deviation of the smaller roll are derived and essentially verified by experiments to a certain extent of deviation.

AUTHOR: SUN Benrong [1327 2609 2837]

ORG: Central Iron and Steel Research Institute

TITLE: "Recrystallization of Austenite during Controlled Rolling of Nb-containing Low-carbon Steel"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 32-37,31

TEXT OF ENGLISH ABSTRACT: An investigation was made of the effect of Nb on the retardation of recrystallization of austenite and refinement of ferrite grain size in hot-rolled Nb-containing low-carbon steels. Experiments of hot-rolling by one-pass were performed using seven kinds of vacuum-melted steels with various C and Nb contents. The main results obtained are as follows:
1) The retardation of recrystallization of austenite during the hot-rolling process in these steels is due mainly to Nb (C, N) content which has been in solution at soaking temperatures and finely precipitated in γ matrix during hot-rolling. Therefore, it must be noted that only those Nb contents which may form the Nb (C, N) precipitate, rather than all of the added Nb contents, play the role of retarding the austenite recrystallization during the hot-rolling process.
2) C contents in the steels during cooling, deformation and after deformation have little effect on the speed of Nb (C, N), but with increased Nb contents the speed of precipitation of Nb (C, N) also increased.
3) With the increase of the amount of precipitated Nb (C, N), the critical reduction

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of the recrystallization of austenite grains during deformation is also increased. This effect is more pronounced in the case of partial recrystallization than complete recrystallization of the γ grains after deformation.
4) When γ grain after deformation is not in a state of recrystallization, the average grain size of ferrite after transformation is dependent on the size of the affected austenite grain interface area.

AUTHOR: ZHAO Songyun [6392 2646 4596]
TANG Wenlin [0781 2429 2651]
TONG Dian [4547 7193]

ORG: All of the Xian Institute of Metallurgical and Constructional Engineering

TITLE: "Study of Incomplete Fill at the Side of the Inner Flang-faces of the Web-cutting Open Rolling Pass"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 38-42

TEXT OF ENGLISH ABSTRACT: We put forward a concept concerning the "angle of spread-pulling down." On the basis of analyzing and processing the experimental data the influence of various factors on the angle value is discussed. The regressive equation for estimating the "angle of spread-pulling down" was established by using a regression and orthogonal design method. The relationship between the "angle of spread-pulling down" and the angle of the web-cutting element may be used to evaluate the degree of fill in the flanges, and to control the degree of "non-fill" in the flanges. The results from our original and follow-up experiments show that some conclusions in this paper are correct.

AUTHOR: XU Yepeng [1776 2814 7720]
LI Junhui [2621 0689 1979]
GUAN Zhian [4619 1807 1344]

ORG: All of the Beijing University of Iron and Steel Technology

TITLE: "Research on the Effect of Oil-saving and Reducing NO_x and Oil Coke Particles on Burning Emulsified Heavy Oil"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 43-50

TEXT OF ENGLISH ABSTRACT: There are different versions of the oil-saving effect by burning emulsified oil and the the data of the effect on reducing air pollution being deficient in China. The two problems mentioned above and the mechanism of combustion are studied. It is shown that by burning emulsified heavy oil the coefficient of excess air may be decreased to 1.02 - 1.05 in industrial furnaces and the results in saving oil are about 3.4 - 10 percent. When care is not taken to control the coefficient of excess air, an opposite result may be obtained. In addition, the effect of reducing the NO_x and oil coke particles is obvious. The amount of NO_x is reduced by 40 percent, and that of oil coke is reduced by 60 percent. The structure of oil coke obtained by burning of unemulsified heavy oil is that of carbonceous residues; that by burning emulsified heavy oil is fine particles which is most like tarry gas phase deposit. This result is consistent with the result obtained from laboratory experiments of single oil droplet burning. The size

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of droplets and the stability of emulsified heavy oil prepared by mechanical stirring may be satisfied with the demand of test and production.

AUTHOR: LI Rong [2621 2827]
YU Weile [0060 4850 2867]
ZHU Jing [2612 7234]
ZHAI Zhongsheng [5049 0022 3932]

ORG: All of the Central Iron and Steel Research Institute

TITLE: "Investigation of the Embrittlement Due to Slow Cooling in High Temperature Range in 18Ni Maraging Steel"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 51-57, 62

TEXT OF ENGLISH ABSTRACT: Many investigators have studied the embrittlement due to slow cooling in the high temperature range in 18Ni maraging steel. It is generally believed that the embrittlement is related to the precipitation of TiC and Ti (C, N) on prior austenite grain boundaries. We have systematically investigated the regularities, behavior and causes of the embrittlement and have obtained results different from those obtained by our predecessors. The main results are as follows: after high-temperature annealing (1200°C, 1 hr), and in intermediate isothermal holding at the most sensitive temperature (950°C), lots of M_3B_2 clusters precipitate on prior austenite grain boundaries and form a network thereon. It is the precipitates that cause the embrittlement of the steel. Moreover, ways to control and eliminate the embrittlement are also researched.

AUTHOR: LIU Zuen [2692 4371 1869]
CAI Qigong [5591 0366 7255]
WANG Degen [3076 1795 2704]

ORG: All of the Central Iron and Steel Research Institute

TITLE: "The Application of Fracture Physics Parameter σ_I^* in Controlled Rolling"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 1, 1982 pp 58-62

TEXT OF ENGLISH ABSTRACT: The micromechanism for improving the mechanical properties of steel by controlled rolling is investigated based on the physics of cleavage fracture.

According to the physical model of cleavage fracture of 16Mn steel and the experimental results of controlled rolling, the idea of alloy design by lowering the carbon content and decreasing the grain size in order to improve the strength and fracture properties was discussed. Along this line micro-alloy steel 05MnMoNb for controlled rolling was designed and investigated. Experimental results show that the steel satisfies successfully the requirements of X70 grade line pipe steels.

9717
CSO: 4009/265

AUTHOR: SU Hongzhi [5685 1347 1807]

ORG: Beijing Institute of Iron and Steel Technology

TITLE: "Determination of the Configurations of Flow Ellipsoids at the Mine"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 1-6, 80

TEXT OF ENGLISH ABSTRACT: Determination of the configuration of flow ellipsoids at the mine is an important link between scientific research and production practics in ore flow. The aim is to reduce ore loss and dilution during the process of ore flow. The main contents of this paper are: description of the method of encircling primarily the flow ellipsoids pattern, method of checking the pattern, the necessity of plotting curves showing the relationship between parameters of the adopted flow ellipsoids and their volumes, derivation of a formula for calculating the volume of the flow ellipsoids and discussion of the similarity of the connecting line of the top points of the flow ellipsoids to a parabola.

AUTHOR: MA Yuanlin [7456 0337 2651]
YANG Guitong [2799 2710 2717]

ORG: Both of the Maanshan Institute of Mining Research

TITLE: "Effect of Blasting Vibrations on Rock Slopes"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 8-13

TEXT OF ENGLISH ABSTRACT: The rock slope of an open pit is substantially a part of the mountain body and is a semi-infinite medium which consists of the same material as the gound. From this viewpoint, the paper describes how vibration waves are transmitted through the rock slope and how the stress field is distributed on rock slopes. It deals with the dynamic property of rock masses and the method of defining the safe charge weight.

The paper gives examples of calculation of how blasting vibration influences the stability of the rock slope.

AUTHOR: ZOU Dingxiang [6760 1353 4382]

ORG: Maanshan Research Institute of Metals

TITLE: "Analysis and Calculations of the Stress State and Efficiency of Impact Penetration System"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 15-22

TEXT OF ENGLISH ABSTRACT: In this paper, the Hertz theory of contact stress is introduced for the theoretical study of impact penetration, and a nonlinear theoretical model founded on the assumption that local deformations are yielded on both impact surfaces of bars is also proposed.

Based on the literature and the differential theorem, a calculating method using a digital computer for analyzing and calculating the stress state and efficiency of impact penetration system is established in a systematic way. A computer program for any system composed of a one-three segmental piston and a one-three segmental rod and/or bit has been designed. The mechanic parameters, the shapes of impact wave on any section and the efficiency of various impact penetration systems can be obtained by changing the values of input variables.

For verifying the theory presented in this paper, the stress state and efficiency of the impact penetration system of the down-hole drill is researched by combing

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the calculating method of the computer with model experiments. The theoretical wave shapes of stress plotted by calculating with the digital computer tally quite well with the experimental wave shapes.

AUTHOR: LIU Chuanlin [0491 0278 7792]

ORG: Sanhe Lead and Zinc Mine, Guangxi

TITLE: "Separating Copper-Lead Concentrate by Flotation with Sodium Pyrophosphate"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 38-42

TEXT OF ENGLISH ABSTRACT: The new technology of separating bulk copper-lead concentrate with cyanide-free and bichromate-free reagents tested in the past two years has shown that sodium pyrophosphate, especially in combination with carboxymethyl cellulose (CMC), as a selective depressant of galena could produce satisfactory separation performance. For instance, separation of bulk copper-lead concentrate assaying about 64 percent Pb and 4.4 percent Cu with the above-mentioned reagents in flotation yielded a copper concentrate containing 27.65 percent Cu and 2.2 percent Pb with copper recovery of 96 percent, and a lead concentrate containing 75 percent Pb and 0.208 percent Cu with lead recovery of 99.47 percent.

Tests have also shown that the consumption of sodium pyrophosphate, its ratio to CMC and the consumption of this mixture, the type of CMC, the reagent conditioning time and other factors all had important effects on the bulk Cu-Pb concentrate separation by flotation.

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Experiments on varied reagent systems for separating Cu-Pb concentrate indicated that sodium pyrophosphate, especially in combination with CMC, provided better results than those with CMC or bichromate. As a result, this new process, confirmed by experiments, has been adopted in mill practice.

AUTHOR: WANG Changren [3769 1603 0117]
WANG Zhi [3769 2535]

ORG: Both of the Northeast Institute of Technology

TITLE: "Study of the Magnetic Field Characteristics of Magnetized Ferromagnetic Wires and Their Technical Parameters"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 43-50

TEXT OF ENGLISH ABSTRACT: A short review of the magnetic field characteristics of magnetized ferromagnetic wires used in the high gradient magnetic separator and of the existing problems is given.

Based on the similarity principle, magnetic simulation is used for the systematic study of the magnetic field of magnetized ferromagnetic wires. The study includes: the effect of the material and the form of the cross section and dimension of the ferromagnetic wire on the magnetic force of the magnetized field, and the field distribution of the wire array. By means of mathematic treatment and calculation, parameters of ferromagnetic wire with round and oblong cross sections are optimized. These parameters can be of use in ore testing and in practice.

Results derived from theoretical consideration are confirmed by experiments on ore separation.

AUTHOR: HUANG Liming [7806 0448 2494]
CHEN Wanxiong [7115 8001 7160]
CHEN Jin [7115 5660]

ORG: All of the Central-south Institute of Mining and Metallurgy

TITLE: "The Flocculation Characteristics of Ilmenite and Feldspar"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 51-58

TEXT OF ENGLISH ABSTRACT: This paper describes in detail an investigation of selective flocculation of ilmenite from ilmenite-feldspar mixtures using a partially hydrolyzed polyacrylamide flocculant and a modified polyacrylamide possessing hydrozimic acid functional groups. It has been found that the lattice impurities and surface conditions of feldspar and the ion constituents of suspension have remarkable effects on the flocculation behavior of minerals and the selectivity of the process. The unfavorable effects as mentioned above can be decreased or eliminated after adding some auxiliary reagents or treating the feldspar with hydrochloric acid, thus improving the selectivity of the process.

The flocculation selectivity can be improved significantly by combining the flocculant with oxidized paraffin soap. An ilmenite concentrate with a grade of 47.05 percent TiO_2 and recovery of 84.9 percent is obtained from a mixture of

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ilmenite and feldspar containing 25.06 percent TiO_2. Another ilmenite concentrate obtained from a mixture of ilmenite and acid-leached feldspar is 48.14 percent TiO_2 in grade and 88.7 percent in recovery, respectively.

AUTHOR: SHEN Shiying [3088 2514 5391]

ORG: Northeast Institute of Technology

TITLE: "The Regularity of Decrease of Trace Metal Concentration in Aluminum during Determination of Current Efficiency in Aluminum Electrolysis by Dilution Technique"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 59-64

TEXT OF ENGLISH ABSTRACT: In the present work the regularity of decrease of trace metal concentration in liquid aluminum cathode in industrial aluminum cells was discussed. Theoretical formulas were derived.

General:

$$a_{n-(s+1)}(t)=\frac{C_0\prod_{i=0}^{s}\left(M_0+\bar{q}t_i-\sum_{j=0}^{i}m_j\right)}{\left(M_0+\bar{q}t-\sum_{j=0}^{s}m_j\right)\prod_{i=0}^{s}\left(M_0+\bar{q}t_i-\sum_{j=0}^{i-1}m_j\right)} \quad (1)$$

Simplified 1:

$$a_{n-(s+1)}(t)=\frac{C_0}{M_0+\bar{q}(t-t_n)}\left(\frac{M_0}{M_0+\bar{q}t_c}\right)^n \quad (2)$$

Simplified 2:

$$a_{n-(s+1)}(t_s)=a_0k^n \quad (3)$$

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where

$$k = M_0/(M_0 + \bar{q}t_c)$$

When compared with practical data they are in good agreement.

AUTHOR: ZHOU Qianduan [0719 0578 0551]

ORG: Guizhou Aluminum Plant

TITLE: "Determination of the α-Al_2O_3 Content in the Alumina Roasting Product by the 'True Specific Gravity Method'"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 65-70

TEXT OF ENGLISH ABSTRACT: Based on the phase analysis, this paper searches deeply into the phase form of alumina at various temperatures and its transformation law, ascertaining the phase composition of the alumina roasting product so that the theoretical foundation is established for a new method for the quantitative analysis of α-Al_2O_3 in the alumina roasting product--the "True Specific Gravity Method." Moreover, the reliability and sensitivity of the "True Specific Gravity Method" are shown in this paper and the results from the testing of the new method are compared with those from the "Diffractometer Method." The comparison shows that there are no apparent differences between the accuracy (or reliability) and reproducibility (or stability) in determining data of the two methods. Furthermore, the "True Specific Gravity Method" has the following advantages: 1) The specimen amount for producing data is dozens of times more than that of the "Diffractometer Method," so the representativensss of the results from the "True Specific Gravity Method" for the whole roasting product is much better; 2) The results can be obtained in two to three hours and used to analyze the production situation and to guide the

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production or experiment just in time; 3) There is no harm from X-rays and the labor conditions are good; 4) There is no need for expensive precision instruments or for a particular working environment, so the method suits one's convenience quite well.

The sensitivity of the "True Specific Gravity Method" is 2 percent. This level is slightly lower than that of the "Diffractometer Method," but is quite enough to satisfy the requirements of production for α-Al_2O_3 quantitative analysis.

AUTHOR: XIA Guangxiang [1115 0342 4382]

ORG: Institute of Chemical Metallurgy, Chinese Academy of Sciences

TITLE: "Extracting Copper from Ammoniacal Solutions by Lignite Adsorption Technique"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 71-76, 58

TEXT OF ENGLISH ABSTRACT: Adsorption of copper in ammoniacal solutions by means of lignite and its stripping was investigated. The factors affecting these operations were also discussed. It is shown that the concentration of copper in the depleted solution was below 1 ppm, and the maximum loading with all three specimens, i.e., copper, ammonia and carbon dioxide, is 0.30 grams per gram lignite, and the mole ratio of those specimens on the lignite is generally 1:6:2 ($Cu:NH_3:CO_2$). When the loaded lignite was stripped with sulfuric acid, the ammonia on it was first desorbed and the mole ratio of the remaining copper to the ammonia gradually increased from 1:4 to 1:2 until the stripping was completed. According to research results the lignite adsorption technique may be applicable to the following steps of the ammonia extracting copper process: preventing the formation of hard cake during distillation of ammoniacal copper solutions; recovering copper and ammonia from both dilute solutions obtained in solid-liquid separation and waste effluent containing sulfate radical. The technique is especially suited to the reduction roasting-ammoniacal leaching process for extracting copper.

AUTHOR: LI Zhongjun [2621 0112 0971]

ORG: Research Institute of Natural Science History, Chinese Academy of Sciences

TITLE: "Gold Mining in Ancient China"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 1, 1982 pp 78-80

TEXT OF ENGLISH ABSTRACT: The gold production in ancient China is reviewed in this article, based on existing literal records. Gold ores mined in ancient times were divided into placer gold and "hill gold." The placer gold, or "water gold," was mostly obtained from elutriation of river- or lake-bed sands, with some excavated from shafts, while the "hill gold" was mostly recovered from eluvial and hill slope placers, earlier gold placers and vein deposits. Gravity separation was the primary process for gold ore beneficiation in the early times.

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31 March 1982

China Report

SCIENCE AND TECHNOLOGY

No. 155

SYSTEMS ENGINEERING AS APPLIED TO COMMAND AND CONTROL AND NAVAL WARFARE

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CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 155

SYSTEMS ENGINEERING AS APPLIED TO COMMAND AND CONTROL AND NAVAL WARFARE

Beijing XITONG GONGCHENG LUNWENJI [SYSTEMS ENGINEERING PAPERS] in Chinese Jul 81, Science Press, pp 50-55, 56-61, 62-66, 67-71

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COMMAND CONTROL, NAVAL WARFARE TOPICS ANALYZED

Submarine-Surface Ship Combat Modeling

Beijing XITONG GONGCHENG LUNWENJI [SYSTEMS ENGINEERING PAPERS] in Chinese Jul 81, Science Press, pp 50-55, 56-61, 62-66, 67-71

[Article by Xu Xinwen [6079 1800 2429], Naval Academy, Chinese People's Liberation Army : "Simulation of Submarine-Surface Ship Combat"]

[Text] I. Introduction

Combat between submarines and surface ships is a form of naval combat. As in any other combat, the commander's basic task is decision-making. Although there are a multitude of specific decisions, they boil down to decision on the basic questions of (1) whether to attack, and (2) how to attack. Accordingly, a discussion of decision-making should be based on the fundamental objective of combat, i.e., to destroy the enemy and preserve oneself. In combat between submarines and surface ships, the submarine commander tries to sink as many surface ships as possible while minimizing damage to the submarine, while the surface ship commander does everything possible to sink the submarines while minimizing his own losses. We may conclude that one combatant's victory is the other's loss. Taking as a criterion of effectiveness the ratio of the two combatants' average number of victories, we have

$$a = \frac{P}{Q}$$

where P is the submarines' average number of victories and Q is the surface ships' average number of victories.

The submarines strive to maximize the value of a and the surface ships to minimize it. Command in combat has always been based on the commander's skill and experience. The making of quantitative analyses of the problem of destroying the enemy and preserving oneself, i.e. numerical forecasts of victory or defeat, for the commander to use in decision-making is an activity which has developed during the last few decades. This paper is an attempt to use the Monte Carlo method, combined with applied game theory, in a preliminary investigation of combat between submarines and surface ships.

II. Conditions

A. Surface Ships

Surface ships generally operate in small groups of two or three; the usual surface ship capabilities and operational procedures may be assumed to be the following.

1. They zigzag when crossing areas of possible enemy submarine activity, otherwise they take a straight course.

2. When a group which has not received an antisubmarine warfare assignment discovers a submarine ahead of it, it uses its weapons to attack the submarine; when it discovers the submarine at a large bow angle it takes evasive action.

3. After attacking a submarine, the surface ships take evasive action and reload their ASW weapons, attacking again if they have the opportunity.

B. Submarines

Conventionally-powered submarines generally operate in small groups of three to five; submarine operating capabilities and procedures are generally as stated below.

1. They lie in wait in a specified sea area. There are no command relationships between submarines at sea: on the basis of general orders given by the shore-based command, the submarines first proceed to an area ahead of the surface ships, then deploy in a specified formation and approach the enemy at slow speed.

2. When the submarines detect the surface ships, they approach them at right angles and determine the target ships' speed and heading.

3. When the speed and heading have been determined, the submarines calculate and take up torpedo launching positions, then launch their torpedoes.

4. When the surface ships are zigzagging, the submarines approach them on a course perpendicular to their overall heading, moving into a course toward a torpedo firing position at intermediate distance, and attempt to launch their torpedoes before the surface ships can change course again.

5. If the surface ships' course after turning exceeds a critical angle, the submarines continue to approach them at intermediate speed, because if the surface ships suddenly turn toward the submarines, the latter may still have a chance to attack at close range.

III. Solution Procedure

The analytical method or the simulation method may be used for numerical analysis of the course of combat. Using a purely analytical method to describe the combat between submarines and surface ships is rather complex, for the following reasons.

1. The combat is a multistep situation and must be solved using game trees: the set of all terminal vertices {t} for all possible game situations must be watched one-to-one with the payoff set {w}.

2. If we take the period of time before the submarines or surface ships discover their adversaries as the initial game move, then for a simple situation the two players' strategies are discrete and finite. The surface ships may sail a straight course or zigzag, while the submarines can take up any one of a countable set of n waiting deployments.

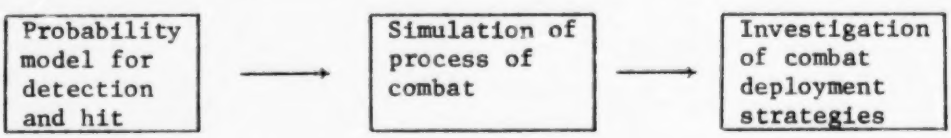
3. After the submarines or surface ships detect the enemy, then each of them will adopt a suitable strategy in the process of continuous maneuvering; the set of strategies will be infinite, making it difficult to use the game tree approach.

4. If we simplify the engagement in order to seek an approximate solution by specifying that the submarine and the surface ships must approach each other and may not withdraw, but must seek a decision, this simplified process can be converted to a game in a unit square. Assume that at a certain time the distance between the combatants is 1. The submarines will use their weapons at a distance x, $0 \leqslant x \leqslant 1$. The surface ships will use their weapons at a distance y, $0 \leqslant y \leqslant 1$. Thus the two players' strategies reduce to selecting the distances (x or y) within the area [0, 1] at which they will use their weapons, and we thus have a game in a unit square. Then, if we let the probability that each side destroys the other when using its weapons be a function p of the range, and if we select strategies F and G regarding the distance at which each side opens fire, then the submarines' victory function and expectation are:

$$H(x, y) = \begin{cases} 1 - (1 - p(x))p(y), & \text{当 } x > y \text{ 时,} \\ 1 - p(y), & \text{当 } x \leqslant y \text{ 时,} \end{cases}$$

$$H(F, G) = \int_0^1 \int_0^1 H(x, y)dF(x)dG(y).$$

But even if we simplify the process in this manner, it is still complex to obtain a numerical solution for the game. Accordingly, in this article we have decided to use a procedure more amenable to numerical solution as follows.


Probability model for detection and hit
Simulation of process of combat
Investigation of combat deployment strategies

Thus we use a probability approach, use the Monte Carlo method to simulate the random process of combat, develop statistics on the simulation results, and use these statistics to obtain average with ratios and construct payoff matrices for the submarines' different deployments against surface ships, thus obtaining a solution for the two-person finite game.

A. Statistical Model

Submarines and surface ships both use sonar to detect each other, and we may consider that their probabilities of detecting each other within direct propagation range (i.e. ignoring sea-bottom reflection and focusing zones) are given by the following formula:

$$p(x) = 1 - \exp\left(-\int_0^x \lambda(t)\,dt\right),$$

where $\lambda(t)$ is the instantaneous detection probability, which can be approximated by a quadratic function of the reflected wave energy $E(t)$ as follows:

$$\lambda(t) = AE(t) + BE^2(t)$$

and

$$E(t) = \begin{cases} 40\log\left(\frac{r}{R}\right), & (r < R), \\ 0, & (r \geq R). \end{cases}$$

Of course, if we use statistical data on actual observation distances, we can also directly derive a formula relating detection probability to distance by using regression analysis.

We compile discrete data for N observations over target detection ranges, letting n_i be the number of times the targets were detected at distance r_i. Since the target is only detected when approaching, the detection probability p_i is:

$$p_1 = \frac{n_1}{N},$$

$$p_2 = \frac{n_2}{N}\,\frac{1}{(1-p_1)},$$

$$\vdots$$

$$p_i = \frac{n_i}{N}\,\frac{1}{(1-p_1)(1-p_2)\cdots(1-p_{i-1})}.$$

We introduce x, such that $x = \frac{r}{R}$, where R is the maximum target detection distance, and apply the method of least squares, obtaining

$$p = a_0 + a_1x + a_2x^2 + a_3x^3.$$

The coefficients a vary with the observational data. According to our data and computations, a_0 and a_2 are approximately equal to 1 and -1 respectively, and a_1 and a_3 to approximately zero. Accordingly we obtain the following formula relating target detection probability to instantaneous range:

$$p(r) = 1 - x^2 = 1-(\frac{r}{R})^2$$

The weapon error against the target is normally distributed and its density function is

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{x^2}{\sigma^2}\right),$$

where σ is determined by weapon dispersion and target dispersion, i.e. by the capabilities of the weapon and observing equipment and the proficiency of the manning personnel. If the definite integrals of the density function are found in a given region for different weapons and targets, the weapon hit probabilities can be obtained.

B. Combat Simulation

Simulation of the encounter between a submarine and a surface ship begins with a random initial state before target detection. The process as a whole includes: target detection; maneuver to take up positions suitable for use of weapons by each of the combatants; use of the weapons; ultimate determination of the results of use of the weapons.

In order to simplify the simulation process, we modeled the various pure game situations composed of the two combatants' strategies before mutual detection. Before the group of surface ships detects the target they may use the strategy of sailing a straight course or zigzagging. Before the submarines have detected their targets they may use three deployment strategies: line abreast, V formation, or inverted V formation, so that there are six pure situations. We carried out 1,500 simulation runs with these 6 pure situations. Most of them involved a combat maneuver process following target detection, but in some of them the surface ships passed out of the submarines' zone of action before either combatant discovered the other, so that no encounter resulted.

When the surface combatant group was zigzagging, the simulation was time-stepped with a 2-minute interval, and event-stepping was used only in a few cases. When the surface combatant group was sailing a straight course, the simulation process was event-stepped, with time-stepping inserted in individual subroutines. A block diagram of the procedure is appended ([Figure 1.1]; I is the sequential number of the simulation run, T is the time, X and Y are the position coordinates, H is the heading, TQ is the turning time, X_d is the bow angle, ΔT is the time interval, and N is the total number of simulations).

Key:

a. Submarine initial state valuation variables X,Y,H
b. Enemy initial state valuation random variables X,Y,H,TQ
c. Distance apart D
d. Enemy zigzagging
e. Enemy detected?
f. Position of two sides after ΔT
g. Submarine determines position of enemy
h. Positions of two sides after ΔT
i. Distance apart D
j. Enemy zigzagging
k. Is D < D for attack by submarine?
l. Hit?
m. Detected by enemy?
n. Is X_d less than bow angle for attack on submarine?
o. Is D < D for attack on submarine?
p. Attack preparations complete?
q. Submarine hit?
r. Do two sides disengage?
s. Average cumulative result, print out, stop
t. Cumulate results

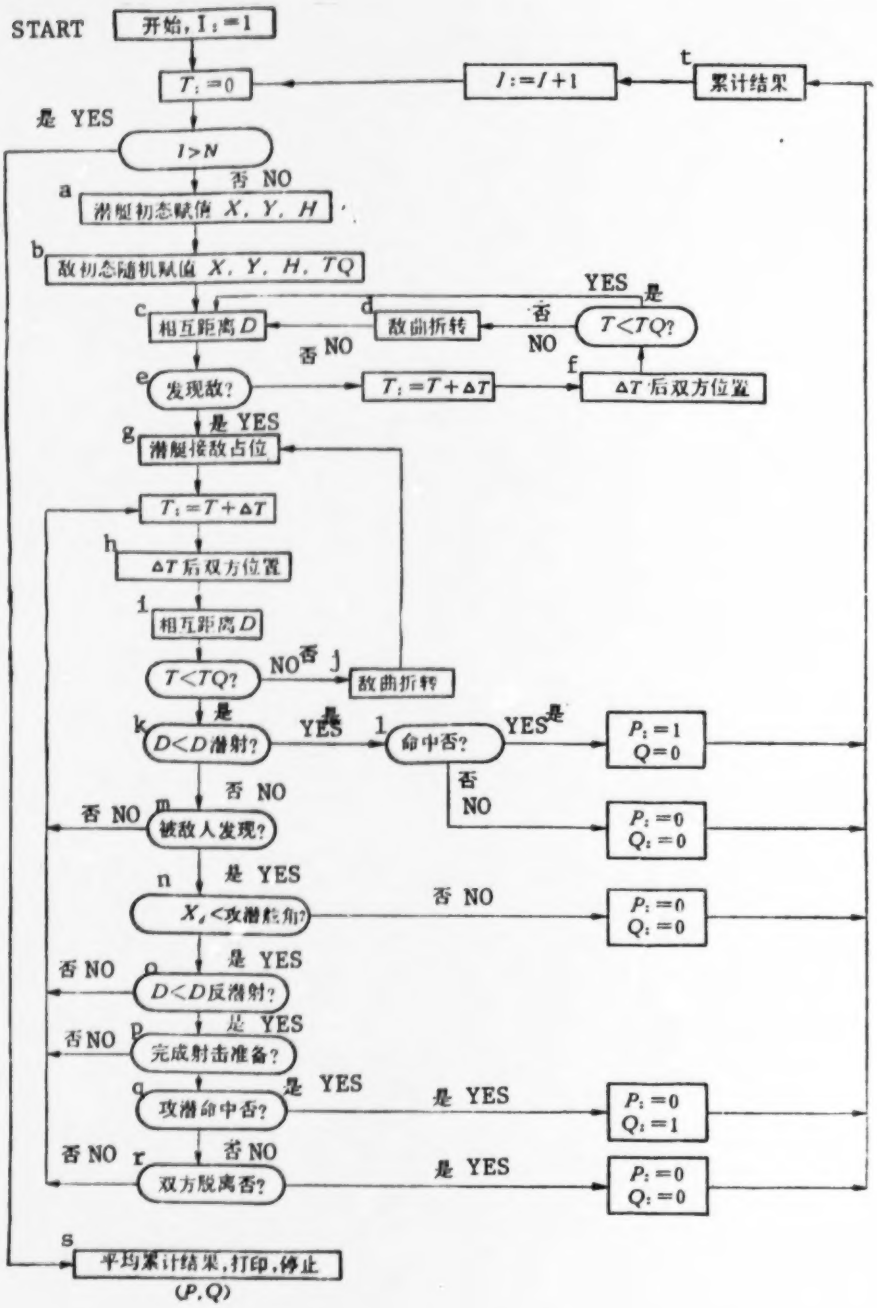


Figure 1.1

C. Investigation of the Game

The statistical results yield a two-person game between submarines and surface ships:

$$G = \{S_1; S_2; A\},$$

where $S_1 = \{\alpha_1, \alpha_2, \alpha_3\}$, and α_1 denotes line abreast deployment of the submarines, α_2 denotes V formation, and α_3 denotes inverted V deployment; $S_2 = \{\beta_1, \beta_2\}$; where β_1 denotes use of a straight course by the surface ships and β_2 denotes zigzagging; $A = (a_{ij})$, where $a_{ij} = P_{ij}/Q_{ij}$ and P_{ij} and Q_{ij} are the statistical modeling results.

Given the above conditions, the game has an optimum pure strategy solution:

$$\max_i \min_j a_{ij} = \min_j \max_i a_{ij} = v = a_{22}$$

This means that for the submarines to win the maximum number of victories with minimum losses they should deploy in V formation, while for the surface combatants to sink as many submarines as possible while minimizing hits by the submarines, they should zigzag.

IV. Preliminary Results

The combat simulation results can be used as a quantitative reference data for decision by the commander, i.e. when he is considering in quantitative terms whether or not to attack and how to attack. The submarine commander's considerations are given below.

A. When both sides are using optimal pure strategies, the submarines' attack success rate will be lower than the submarines; loss rate ($v < 1$). Considered in terms of repeated encounters, this is a situation in which losses exceed gains for the submarines. In order to avoid combat in which victories do not outweigh losses, the submarines should avoid engaging destroyer combat formations.

B. If under specific circumstances the submarine must engage a small destroyer group, a way of improving tactics should be sought. We analyzed 250 simulations in which a single submarine attacked a single surface ship and discovered that two aspects of the assumed submarine operating principles needed improvement.

1. When the submarine detects its target at long range, the target's initial conditions have a clear effect on the outcome. When the target's bow angle is less than a limiting value, the submarine's success rate is between 40 and 50 percent, but when the bow angle exceeds this limiting value, the submarine's success rate is less than 10 percent; in the latter situation the probability of the submarine's being destroyed greatly exceeds the probability of its being victorious. If the submarine detects a target at intermediate distance at a bow angle exceeding the critical value it should give up the attack; but if

the target bow angle is smaller than the limiting value the submarine should strive to engage this ship.

2. About 80 percent of the occasions on which a submarine sank a surface ship occurred when the surface ship had unsuccessfully attacked the submarine. On these occasions the bow angle of the target was between 50° and 60°. Accordingly, after the submarine had avoided the enemy attack, it should rapidly determine the target's bow angle. It is between 50° and 60°, then it should rapidly position itself for the attack; otherwise it should withdraw immediately to avoid another attack by the enemy.

C. Our combat simulation results also indicate that if the submarine uses long-range homing torpedoes instead of straight-course aerodynamic torpedoes, increases its speed and improves its sonar countermeasures equipment so as to decrease the probability of detection by the enemy, increases its own detection range and the like, it will increase its win rate.

To summarize, we believe that the combat simulation is an advance in tactical research. In the combat problems with which we are dealing we generally are unable to carry out full-scale exercises in a situation fully resembling combat, and even if we could carry out such exercises we would be unable to perform large numbers of repetitions. Because of the effect of random factors, it would also be hard for us to rely on the results of one or two trials. If we used map or laboratory model simulations, the time required for each simulation usually would greatly exceed or at best would be equal to actual combat time. If we assume that each encounter between a submarine and a destroyer takes an average of 40 minutes, 1,500 tests would require 1,000 hours, equivalent to half a year, while with a 709 computer, 1,500 trials can be compressed into a few hours of simulation time, yielding statistical results. Accordingly, the combination of computers and combat simulations methods should be an inseparable part of military systems engineering; it is a branch of military command and tactical research which urgently requires broader utilization and development.

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Ship Measures Against Bombing

Beijing XITONG GONGCHENG LUNWENJI [SYSTEMS ENGINEERING PAPERS] in Chinese Jul 81 pp 56-61

[Article by Sun Shaoguang [1327 4801 0342], Huang Xinghui [7806 1198 1920] and Xiong Jiguang [3574 0679 0342], Unit 38641, PLA: "Preliminary Discussion of Optimal Methods of Defense Against Enemy Low-Altitude Horizontal Bombing for a Certain Type of Ship"]

[Text] I. Formulation of the Problem and Description of the Conditions

Bombing conducted by aircraft at an altitude (H) of 100 to 1,000 meters is called low-altitude horizontal bombing. This is still one of the likely methods of attack by enemy aircraft.

When a ship underway detects an enemy aircraft making a bombing run it can use medium- or small-caliber antiaircraft guns against within their effective range. Although the questions of choice of electronic countermeasures or of the moment of firing or type of fire of antiaircraft weapons are important, the present article focuses on the effect which the ship's maneuvering has on antiaircraft defense and evasion effectiveness. Ship maneuvering has always been recognized as a last resort in dealing with attack. It can alter the range deviation a and lateral deviation b of the center of the bomb impact dispersion pattern relative to the ship, as well as the angle α between the ship's heading and the bomb trajectory, thus changing the hit rate; but it also changes the number of guns engaged in repelling the attack and to a certain extent decreases the antiaircraft guns' accuracy. Accordingly the question arises as to how to select types of maneuver (including the moment at which to start an evasive turn, the direction of the turn, the turning speed and the like) so as to minimize the probability of damage to the ship, thus achieving the best defensive measures.

Low-level horizontal bombing by enemy aircraft generally involves stick bombing by a formation or single aircraft; aircraft with a small bomb load may use cluster bombing. In terms of the bomber characteristics and statistical data on common attack types, we can use the following attack conditions.

--The enemy aircraft conduct stick bombing in three-plane V formation from an altitude of 600 m. The aircraft are 60 m apart, with sighting by the leader. Each aircraft drops a stick of six 250-kg bombs with a spacing of 20.8 m. The aircraft speed V_d is 200 m/sec. The horizontal distance to the beginning of the bombing run is D_3 = 500 m and the sighting time is 16 seconds; the horizontal distance to the bomb release point is $D_8 \approx 1{,}800$ m. The probable range and lateral deviation of the bombs are 73.8 and 57.7 m respectively.

--A single aircraft carries out cluster bombing (two 250-kg bombs) at an altitude of 600 m with the other conditions as above.

--An enemy aircraft at 300 m carries out stick bombing (six 250-kg bombs): V_d = 200 m/sec, D_3 = 4,500 m, sighting time 15 sec, $D_8 \approx 1{,}500$ m, bomb spacing 10.8 m. Bomb deviation 67.5 m range, 52.7 m lateral.

The basic combat scenario (see Figure 2.1) is as follows.

Starting at point d_0 (relative to ship, the bow angle is X_{W_0} and the distance is D_0) the aircraft approaches the ship at velocity V_d on a heading $\overline{W_0 d_0}$; at point d_3 it turns into attack heading $\overline{d_3 d_8}$, sights, and if not destroyed by antiaircraft fire, releases its bombs at d_8, then withdraws.

The ship opens fire with medium-caliber guns at W_0, and with small-caliber guns at W_4, and continues firing until the aircraft is destroyed or the bombs are released (ship at W_8). While firing, the ship can make an evasive turn at distance D_j ($j = 0, 1, \cdots, 9$) and continue turning until the bombs have fallen, after which it resumes its original course.

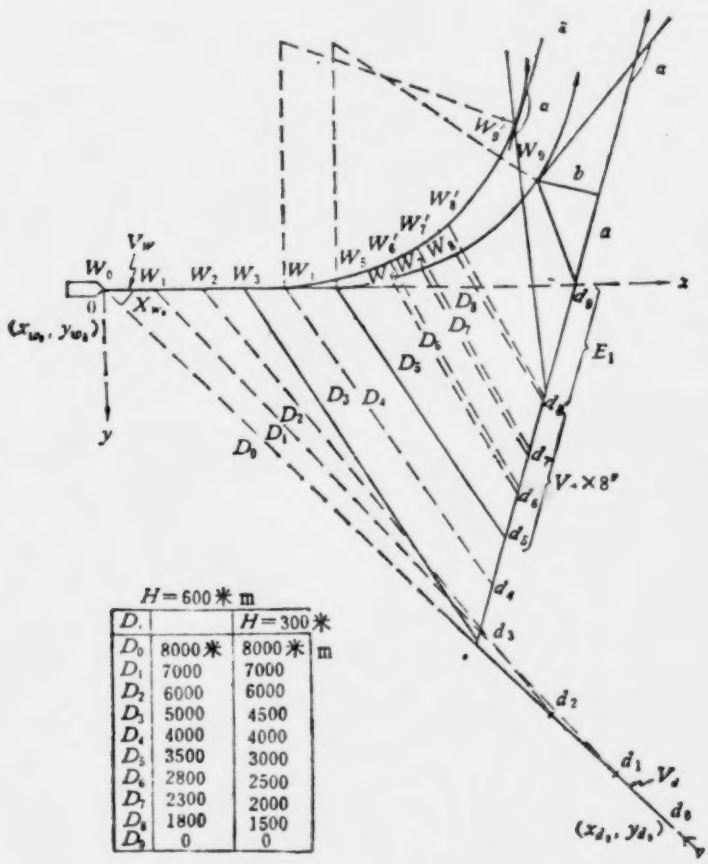

Figure 2.1

In low-altitude horizontal bombing, the minimum time required for the enemy aircraft to perceive and recognize the ship's turn is 5 seconds, and the minimum time required thereafter to resight is 3 seconds. Accordingly, if the

ship begins its turn less than 8 seconds before the enemy aircraft drops its bombs, the enemy aircraft has no time to resight before releasing its bombs. As shown in Figure 2.1, if the ship turns at W_5 or later (distance D_5) the enemy aircraft cannot resight and the bomb dispersion center point will be at d_9, so that a and b will not be equal to zero. If the ship begins to turn before W_5, the enemy aircraft has time to resight and the bomb dispersion center will coincide with the ship's center of area, so that a and b will be equal to zero. Accordingly, we take W_5 as the dividing point and treat the situation as two cases.

II. Mathematical Model

A. Target Function and Variables To Be Selected

The probability that the aircraft is not hit by the antiaircraft fire before releasing its bombs is Q_d; the probability that before the aircraft can be destroyed it achieves at least one bomb hit is P_W; thus the ship's damage probability is

$$P_s = Q_d \cdot P_W$$

The ship begins to turn at distance D_j and the turning direction is z and the angular speed of the turn is ω_z: these are the variables that must be specified. Different values of D_j, z and ω_z correspond to different values of Q_d and P_W. Q_d and P_W are nonlinear functions of D_j, z and ω_z. If we use the equation given above as the target function, the problem is to find a set of values of D_j, z and ω_z which satisfies the equation

$$\min \{P_s = Q_d(D_j, z, \omega_z) \cdot P_W(D_j, z, \omega_z)\}.$$

On the basis of actual ship equipment and command procedures, we specified 10 distances D_j; z was specified as two directions, toward and away from the enemy aircraft; ω_z was specified as a turning speed of 2°/sec (because the optimal value of ω_z had already been obtained using another method). In our solution, we used 13 different values of the bow angle X_{W0} at which the enemy aircraft appears, ranging from 0° to 180° (at 15° intervals). For the Q_d and P_W of each X_{W0} we took $\omega_z = 2°$ and used different values of D_j and z, obtaining different values of P_S, then found min P_S to select the optimal defensive strategy. We call this method the "fixed-point root-extraction optimization method."

B. System of Parametric Equations

1. Ship-Aircraft Equations of Motion

In the system of plane rectangular coordinates x0y (see Figure 2.1) the ship's coordinates are represented as (x_{W_j}, y_{W_j}) and the aircraft's coordinates as (x_{d_j}, y_{d_j}). The ship's starting point is W_0, its bearing is ox and its speed V_w; the aircraft's starting point is d_0, its heading is d_0W_0 and its speed is V_d.

When the equations of motion are used to find the coordinates of all the points d and W, we can calculate the five parameters needed to find Q_d and P_W, i.e. t_j, X_{W_j}, α, a and b.

The quantity t_j is the time required for the aircraft to move from D_0 to D_j; X_{W_j} is the bow angle of the aircraft when it is at the point d_j. Both t_j and X_{W_j} are functions of the specified parameters D_j, z and ω_z and the initial coefficients H, X_{W_0}, D_0, V_W and V_d.

The quantities α, a and b are not only functions of the specified variables and the initial parameters, but also are related to the horizontal distance D_8 at which the airplane releases its bombs, the bomb trajectory E_1 and the bomb falling time t_ℓ.

2. The Probability Q_d That the Aircraft Is Not Destroyed by Antiaircraft Fire

We discuss the air attack in two stages. The first stage extends from the time when the medium-caliber guns open fire until the small-caliber guns open fire, when only the medium-caliber guns are being used against the aircraft. The second stage extends from the time at which the small-caliber guns open fire until the aircraft drops its bombs: during this time the medium and small caliber guns are both firing, but in our calculations we equate the effectiveness of the medium-caliber guns to that of the small-caliber guns.

Let $P^{(1)}$ and $P^{(2)}$ be the probability of destroying the aircraft in stages 1 and 2 respectively, let N_1 and N_2 be the average number of shells which must be fired by medium- and small-caliber guns respectively to destroy one enemy aircraft, and let $m^{(1)}$ and $m^{(2)}$ be the total number of projectiles fired by the medium-caliber and small-caliber guns respectively against the aircraft. Then

$$Q_d = 1 - \{P^{(1)} + (1 - P^{(1)})P^{(2)}\},$$

where

$$P^{(1)} = 1 - \left(1 - \frac{1}{N_1}\right)^{m^{(1)}},$$

$$P^{(2)} = 1 - \left(1 - \frac{1}{N_2}\right)^{m^{(2)}}.$$

3. The Probability P_W That the Aircraft Scores at Least One Bomb Hit

We denote the probabilities that the aircraft scores at least one hit in distance terms and direction terms by P_L and P_B respectively, so that $P_W = P_L \cdot P_B$ · the quantities P_L and P_B are functions of α, a and b, and are also related to the length, breadth, height and speed of the ship, and the number of enemy aircraft, their spacing in the formation, the altitude at which they drop their bombs and their speed, direction and number, the spacing of the bombs in the stick, the angle of fall of the bombs and their probability distribution.

III. Analysis of Solution Results

Some of the results obtained are presented in Table 1.

Table 2.1 Some Results of Calculations on Defense Against Low-Level Horizontal Bombing With $\omega = 2°/sec$ (Q_d, P_W, P all given as percentages)

	X_{W_0} / z		0°	30°		60°		90°		120°		150°		180°
				背 A	向 T	背 A	向 T	背 A	向 T	背 A	向 T	背 A	向 T	
formation, stick bombing	编队连投	Q_d	100	79.7	86.3	82.9	85.7	82.3	85.9	78.2	77.7	81.3	73.1	100
		P_W	7.78	13.1	6.47	11.5	7.72	7.75	7.72	6.97	15.2	6.63	11.4	7.73
		P_{1max}	7.78	10.5	*5.59	9.57	*6.62	*6.38	6.63	*5.45	11.8	*5.39	8.38	7.73
		D_j	D_1	D_9	D_3	D_8	D_2	D_4	D_6	D_5	D_7	D_7	D_7	D_9
single plane, stick bombing	单机连投	Q_d	100	77.1	83.3	81.4	84.8	82.0	84.3	80.0	69.8	79.3	71.1	100
		P_W	1.04	3.17	0.80	3.01	1.04	1.04	1.55	1.04	4.45	0.84	2.66	1.04
		P_{1max}	1.04	2.44	*0.67	2.45	*0.88	*0.85	1.31	*0.83	3.11	*0.66	1.89	1.04
		D_j	D_1	D_9	D_3	D_8	D_2	D_4	D_6	D_5	D_7	D_7	D_7	D_9
single plane, cluster bombing	单机齐投	Q_d	98.2	85.4	86.3	82.6	80.3	79.5	79.0	78.2	77.7	81.3	78.8	98.7
		P_W	1.05	1.11	1.04	1.09	1.13	1.13	1.14	1.10	1.14	1.09	1.12	1.10
		P_{1max}	1.05	0.95	*0.90	0.94	*0.90	*0.90	0.90	*0.86	0.89	*0.88	0.88	1.09
		D_j	D_1	D_9	D_3	D_8	D_2	D_4	D_6	D_5	D_7	D_7	D_7	D_9

Key: T = towards; A = away

A. Analysis of the Probability P_W That the Aircraft Has at Least One Bomb Hit and the Probability Q_d That It Is Not Destroyed by Antiaircraft Fire

P_W is related to α, a and b; the effects of these quantities on P_W differ with the type of bombing.

Figure 2.2 shows that in stick bombing by formations and by individual aircraft, changes in α (when $D_j = D_9 = 0$ m, X_{W0} is close to α and can be treated as equal to α) cause changes in P_W by factors of 2.2 and 5.1 respectively; the values $P_{W_{max}}$ for both these types of bombing occur at $X_{W0} = 90°$, while $P_{W_{min}}$ occurs at $X_{W0} = 0°$. The angle $X_{W0} = 90°$ is the most advantageous approach angle for the enemy in order to maximize the quantity P_W in stick bombing, while $X_W = 0°$ (or 180°) is the least favorable angle. When a and b are not equal to zero, the value of P_W is changed, but never by more than 100 percent. Accordingly, in low-altitude stick bombing, α has the primary effect on P_W, while the effect of a and b is secondary.

It can be seen from Figure 2.3 that Q_d is relatively little affected by the type of bombing used. $Q_{d_{max}}$ occurs at $X_{W0} = 0°$ or 180° (minimum attach success), while $Q_{d_{min}}$ occurs at $X_{W0} = 120°$ (maximum attack success). Differences in X_{W0} (α) can change Q_d by a factor of up to 1.4.

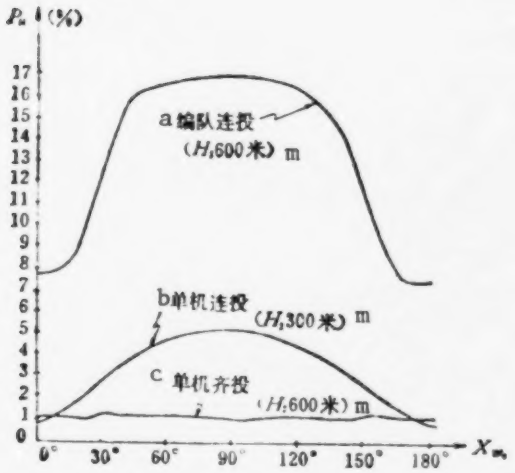

Figure 2.2 Plot of P_W Against X_{W_0} (for $D_j = D_9$)

Key:
a. Stick bombing by formation
b. Stick bombing by single aircraft
c. Cluster bombing by single aircraft

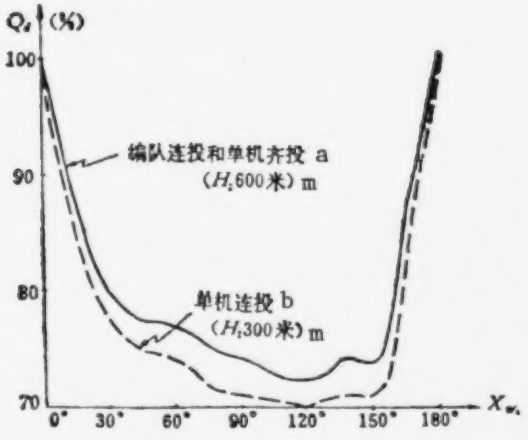

Figure 2.3 Plot of Q_d Against X_{W_0} (for $D_j = D_9$)

Key:
a. Stick bombing by formation and cluster bombing by single aircraft
b. Stick bombing by single aircraft

As the foregoing analysis indicates, the optimum solution for stick bombing by formations and single aircraft is determined by the location by which P_{Wmin} occurs, while Q_{dmin} is a secondary factor. When the aircraft use cluster bombing at 600 meters altitude, because when $D_j = D_5$ the value of P_W can vary by a factor of 1.14 to 1.24 and Q_d can vary by a factor of 1.07 to 1.18 (see Table 2.2), P_W is still the main optimization factor. A particularly striking point is that no matter what the value of X_{W0}, the value P_{Wmin} always appears at D_5 (because turning by the ship at this point produces the maximum values of a and b).

Table 2.2 Comparison of Change in Q_d, P_W for Cluster Bombing by Single Aircraft (Q_d, P_W given as percentages)

X_{w_0} / z	0°	30°	60°	90°	120°	150°	180°
		向 T	向 T	背 A	背 A	背 A	
Q_d(D_5时) time D_5	98.76	86.35	87.17	79.57	78.25	81.32	98.74
Q_{dmin}	86.44	79.70	76.77	73.44	72.08	73.16	83.95
比值 ratio	1.14	1.08	1.07	1.08	1.09	1.11	1.18
P_{Wmax}	1.29	1.29	1.29	1.29	1.29	1.29	1.29
P_W(D_5时) time D_5	1.05	1.04	1.09	1.13	1.10	1.09	1.10
比值 ratio	1.23	1.24	1.18	1.14	1.16	1.18	1.16

Key: T = towards; A = away

B. Analysis of Ship Damage Probability P_s and the Specified Variables

In this article we take the solution min P_s as indicating the optimal defense plan. But the solution min P_s is primarily dependent on the point at which $P_{W_{min}}$ occurs. Table 1 indicates the following.

The optimal value of the turning direction z is the same regardless of which bombing method the enemy uses. When $X_{W0} < 90°$, min P_s for a turn toward the enemy aircraft is smaller than min P_s for a turn away from it, so that the optimal solution is to turn towards the enemy aircraft. When $X_{W0} \geqslant 90°$, min P_s for a turn away from the aircraft is smaller than min P_s for a turn toward it, so that the optimal solution is to turn away from it.

The distance D_j at which the turn is begun has the same optimal value for stick bombing by formations and by single aircraft. The basic principle for finding D_j in this case is to let α equal 0° or 180° and obtain the minimum of P_W. The actual distances D_j for the beginning of the turn are given in Table 1. When the enemy aircraft are using cluster bombing (H = 600 m), the optimal distance D_j is found by maximizing the displacement of a and b, so that the optimal solution is to begin the turn at point W_5 (time D_5) when the enemy aircraft will not have time to correct the bomb release. The horizontal distances between the aircraft and the ship corresponding to the values of D_j given in Table 1 do not take account of the change in horizontal distance between the time at which the commander gives the order and the time at which the ship begins to turn; in practical use this distance should be taken into account.

The optimal solution for turning speed ω_z is top speed and full rudder.

IV. Conclusion

Low-level horizontal bombing is a method of aerial attack on warships. Currently, low-altitude bombing is generally carried out at altitudes of 600-800 and 200-300 meters, more frequently in the latter range. But we have obtained the following conclusion regarding the way in which a certain type of warship should defend against these attacks.

When it can be determined that the enemy aircraft is using stick bombing, the evasive maneuver should be to turn broadside ($X_{W0} = 90°$) toward the enemy aircraft; when it can be determined that the enemy is using cluster bombing, the evasive maneuver should be to turn the bow or stern toward the enemy aircraft (approximately $X_{W_0} = 0°$ or 180°).

The warship's maneuvers are: 1. When $X_{W_0} < 90°$, turn toward the enemy aircraft; when $X_{W0} \geqslant 90°$, turn away from the enemy aircraft; 2. the distance Dj at which the turn is begun can be determined from Table 1; 3. the speed of the turn ω_z corresponds to top speed and full rudder.

These conclusions are subject to further verification.

Evaluation of Naval Weapons Systems

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[Article by Ling Ruyong [0407 1172 6978], Naval Systems Engineering Department, Sixth Ministry of Machine Building: "Methods of Evaluating Naval Weapons Systems"]

[Text] Naval weapons systems are the basic force in naval combat. The extremely rapid development of science and technology has resulted in continual upgrading and diversification of these weapons' combat capabilities. The combination of ballistic missiles and nuclear propulsion has caused submarines to develop abruptly from a conventional force capable only of attacking surface ships from underwater concealment into a strategic weapons system capable of destroying major military and economic targets. Surface ships, from patrol boats and corvettes to cruisers and aircraft carriers, are all equipped with a variety of guided missiles and other weapons systems and with large numbers of electronic warfare and command and control systems, and are capable of taking on a wider range of naval combat missions. However, the missions, structures, sizes and combat tactics of the world's navies differ. This results not only from differences in scientific and technological level, but also from the countries' political, economic, strategic and geographic conditions. Against this background, the use of systems engineering methods can help policy-making organs reach scientific conclusions regarding the structure, combat employment and developmental requirements of naval combat systems.[1] Here we inevitably encounter the problem of how to make a quantitative evaluation of the effectiveness of various naval weapons systems.

Under our country's conditions, what are the military economic advantages of developing nuclear-powered ballistic missile submarines? If they are advantageous, how large should they be? These are evaluations questions which must be answered when drafting plans for the development of strategic weapons systems.

Since the early 1960's, some countries have built 80,000-ton guided missile cruisers. How much greater are their capabilities than those of conventional cruisers? What types of employment will yield the best and worst results? These are evaluation questions involved in the study of employment methods.

At every stage in the development of any new naval weapons systems, from selecting employment requirements and performance specifications, fixing prototype design and determining series size to subsequent reequipping and decommissioning, decision-making must take account of the capabilities expected to result from the program.

Quantitative evaluation of naval weapons systems cannot limit itself to technical characteristics. From the systems engineering viewpoint, the important thing is to evaluate the war-fighting and economic effectiveness of weapons systems in terms of the combat potential which they represent. This article is a brief discussion of quantitative evaluation methods.

I. Performance Characteristics and Combat Potential

Naval weapons systems are physical entities, composed of platform subsystems and armament subsystems, which are intended to perform specific missions. We generally use the following performance characteristics to describe these entities: 1. for the platform, rated and fully-loaded displacement, length, breadth and draft, maximum and economic cruising speed, cruising range and self-supporting capability, type of propulsion equipment, shaft horsepower, number of shafts, total personnel; 2. for the armaments, the types, numbers of installations, numbers of tubes, launch velocity, launch trajectory, propellant load and explosive charge, and the types, numbers and characteristics of the fire control and electronic warfare systems of guns, missiles and underwater weapons. The number of characteristics specified depends on the problem being investigated, but it must be limited. The numerical value of each characteristic can be chosen within a certain range, and accordingly there can be a variety of combinations of characteristics.

If the physical entities to which the different sets of characteristics apply meet the requirements of 1. overall system weight, balance and stability, 2. sufficient reliability of the subsystems under specific operating condition, and, 3. compatibility of these subsystems under typical operating conditions, then they are considered to represent feasible systems.[2] Accordingly there is a one-to-one correspondence between sets of characteristics and physical entities.

Any set of characteristics of a naval weapons system represents a certain combat potential, expressed in terms of the ability to destroy the enemy, survive, and accomplish such combat tasks as the following:

1. attacking and destroying various aerial, surface, underwater or shore-based enemy targets;
2. patrolling, picket duty and escort duty;
3. minelaying, minesweeping, amphibious operations and antiamphibious operations.

The question of how to express combat potential in quantitative form is one of the important problems of combat systems engineering. In practice we generally use displacement as a measure of the ship's combat capabilities. This is of value only as a rough estimate. Under modern conditions, it is entirely proper to use a system's ability to carry out combat tasks under specific circumstances, i.e. target destruction probability and expectation, survival probability, target detection probability and expectation, availability, reliability, response rate and the like, to evaluate its combat potential.[3] This is a more scientific method and is amenable to approximate calculation.

In the process of building, maintaining and using naval weapons systems, we naturally must consume certain quantities of resources, and accordingly we may also use cost effectiveness in the evaluation of combat potential.[4]

II. Evaluation Criteria

To select the design characteristics or choose the types of combat employment of either existing or new systems, we need specific evaluation criteria CR (also called evaluation principles, evaluation standards, evaluation functions and the like). These must correspond to the problem-solving goals and conditions; they must have a quantitatively describable relationship to the characteristics or types of employment to be selected; they must reflect the advantages and disadvantages of the system's capabilities; and they must be computable.[2-5]

Evaluation criteria for naval systems generally include:

1. indicators of combat availability and reliability;
2. indicators of engagement effectiveness;
3. indicators of resource expenditures.

Historically, a famous criterion which was successfully used was the sweep formula which the British Operational Research Society (ORS) developed during World War II for aircraft ship search.[5] This criterion was used for making scheduling computations, and analysis of the factors influencing it led to suggestions regarding improvement of aircraft sortie plans, training methods and the development of new search devices, thus greatly improving search and combat effectiveness. A wide variety of similar criteria for different situations are described in the literature (e.g. references 2-5).

In naval weapons system research and development, we need to consider the systems' effectiveness in carrying out n different combat missions during their service life. If a system's availability is R, its probability of survival before attack in each type of combat is S_i, its probability of destroying the target provided it survives is P_i, its expected resource consumption is E_i and its expected noncombat resource consumption during its service life is E_0, and the weighting coefficient for each type of combat is k_i, then we may use the following criterion:

$$CR = (R/E)\sum_{i=1}^{n} S_i k_i \ln[1/(1-P_i)],$$

where

$$E = E_0 + \sum_{i=1}^{n} E_i.$$

In order to calculate the criterion value, we need to construct a series of suitable criterion models.

III. Criterion Models

The effectiveness of a naval weapons system is manifested in a specific combat or resource environment. In addition to the characteristics of the system, these conditions also include the characteristics of the threat (typical targets, resource conditions, the natural environment, and the objectives,

methods and operational principles of the two sides in combat. All of these conditions make up a larger system. We analyze these, identify the main contradictions, and abstract them into a numerical model, which we call an evaluation model. This model reflects the interrelationship between the evaluation criterion and the characteristics or types of operational employment to be evaluated and provides a method of computing the criterion.

Among the possible factors and requirements contained in evaluation criteria we may generally include: an availability model, an engagement model and a consumption model.

A. The Availability Model

This model reflects the mechanisms of the naval weapons system's ability to overcome natural, noncombat degradation and maintain a high degree of seaworthiness and battle readiness; it provides a method of computing system availability.

System availability is mainly determined by the availability of the propulsion subsystem and the various weapons systems.

Natural degradation results from technical and environmental factors. Technical degradation manifests itself as malfunctions produced by failure or wear of mechanical parts and assemblies and electronic components. In order to overcome or decrease this degradation, such measures as increased numbers of spare parts, improved design, institution of suitable maintenance and inspection systems and the like are used. A considerable amount of research has already been done in reliability and component replacement theory relevant to quantitative analysis in this area.[4] Environmental degradation involves a decrease in the system's ability to operate at forecast or designed characteristics in unfavorable weather or sea conditions, for example decreased cruising speed, unavailability of weapons because of violent rolling and pitching and the like. In order to overcome or decrease this type of degradation, such measures as added antiroll equipment or stabilized platforms, improvement of ship design and suitable navigation technology can be used. The results of ship handling theory can be used for quantitative estimation of environmental degradation effects.[3]

A system's combat reliability and battleworthiness can be analyzed in combination with the engagement model.

B. The Engagement Model

This model reflects the mechanism of a naval weapon's system's ability to destroy the enemy under combat conditions while itself surviving and provides a method of computing system survival probability and target destruction probability or expectation.

The engagement is a process characterized by the two combatants' use of measures to destroy each other and control their own damage while they are able to obtain information only gradually and never have complete information.

This process includes many indeterminate factors, because both sides make every effort to maintain secrecy about their armament capabilities, intentions and operational principles. Accordingly, it is impossible to construct an absolutely error-free model and it is necessary to resort to predictive, approximate models which reflect the main combat mechanisms.

Possible characteristics of future warfare indicate that repeated combat between single ships or small groups of ships will be the basic form of encounter. This unquestionably will also be the basis for large-scale encounters. Accordingly, the models described below are rather typical:

1. combat between individual ships, including submarine versus submarine, surface ship versus submarine, and surface ship versus surface ship;[6-7]

2. combat between small combat formations, including surface ship versus submarine or versus other surface ships and groups of aerial targets, and combat of helicopter or aircraft formations against submarines and the like;[8]

3. combat of escort groups against aircraft, surface ships or submarines, protection of sea areas and the like.[9]

Other models include amphibious operations, transport, minelaying and minesweeping and the like.[10] Since World War II, military operations research has reaped a rich harvest of results in investigating these models, such as theory of the employment of guided missiles, guns and underwater weapons, game theory, search theory, (Lanchester) dynamic combat theory, decision theory, electronic countermeasures theory and other relevant theories.[11-13] By using these results we can resolve many questions involving specific types of simple combat.

A basic type of encounter can be summarized by the following model. Suppose that side A's firing position control functions are $u_1(t)$ and $v_1(t)$, and that at time t side A has a probability $f_1(u_1, v_1)$ of destroying side B. Similarly, side B's firing position control functions are $u_2(t)$ and $v_2(t)$, and at time side B has a probability $f_2(u_2, v_2)$ of destroying side A. We denote the survival probability functions of sides A and B as $x_1(t)$ and $x_2(t)$ respectively. Because at any moment during the encounter it is almost impossible that both parties will be destroyed simultaneously, we can derive the following dynamic equations:[4]

$$\dot{x}_1 = (1 - x_1 - x_2)\, f_1(u_1, v_1)$$
$$\dot{x}_2 = (1 - x_1 - x_2)\, f_2(u_2, v_2).$$

In addition we have the initial conditions $x_1(0) = x_2(0) = 1$ and the final condition $x_1(T) = 0 \vee x_2(T) = 0$. These equations can be extended to cases in which both sides comprise several multilevel systems and where the destruction process consists of different levels of destruction.[8] If our goal is only to determine the survival probability functions x_1 and x_2 for the two combatants, then once we have specified the two parties' firing positions $u_1(t)$ and $V_1(t)$, where $i = 1, 2$, it is easy to obtain a solution. If our aim is to select optimal firing position control, we can introduce a suitable

payoff function, then solve the problem as a differential game. Use of this modeling procedure to study relatively complex encounters is likely to be one of the important areas of future development.

C. Expenditure Model

Models of this type reflect the mechanism by which a naval weapons system consumes resources during its service life and provides a method of calculating the expenditure required to realize its capabilities. Such a model is particularly important in drafting a development plan, developing a new system or carrying out modernization and reequipment.[4,14]

The service life of a naval weapons system is generally 15 to 20 years. According to statistics for U.S. destroyers, total noncombat expenditures generally consist of the following categories.

1. development and production expenditures generally account for 28 percent, including expenditures on the construction of new production lines, the development and production of new materials and the like, in addition to which the effect of series size must be considered;

2. servicing and maintenance expenditures account for about 12 percent, including expenditures for constructing special bases, wharves and storehouses, scheduled maintenance, daily servicing, transport and replacement of parts and assemblies;

3. modernization and reequipping account for about 10 percent;

4. personnel training and provision of living accommodations and services, constant operating expenditures and partial war losses account for about 50 percent.

Depending on a system's design, the development and production process and the type of operation and employment, we can use technical-economic and mathematical statistical methods to construct an expenditure model corresponding to the availability model and encounter model.

The foregoing are the three main evaluation criteria to be discussed in this article. Since the early 1960's, one important tendency in the construction and solution of such models has been the extensive use of computer simulation models.[4] These methods are suitable when the factors in the model are very numerous, the factors operating in the process are complex, there is uncertainty and randomness and the mechanism is hard to analyze and express completely. To construct a model in such cases, we use a computer program to describe the objective process and its mechanisms; next we input the data and program into a computer and carry out a large number of computations, equivalent to the taking of samples, then carry out statistical analysis of the results to obtain the solution. Particularly as regards description of the type of encounter involved in the combat, statistical modeling is a very important practical method. It is as though we used the computer to carry out experimental encounters between two armies or sand-table exercises in order to

investigate operational methods, evaluate weapons capabilities, improve the quality of field maneuvers and exercises, and the like. This method is extremely and widely used abroad.[15] Results have also been obtained from work done in this country, including the author's participation in submarine encounter modeling since 1976.

IV. Conclusions

This article summarizes quantitative evaluation methods for naval weapons systems in terms of the systems engineering approach to combat and economic effectiveness. This should be helpful in overcoming onesidedness resulting from exclusive pursuit of advanced technical characteristics in the development process without reference to combat and economic effectiveness.

Once the required criteria and evaluation model have been constructed, the model's inputs are the system's characteristics, operation and employment methods (or doctrines), and relevant environmental factors. Some of the factors in the last two categories must be evaluated or selected. The model's output is the evaluation criterion value. Decision-makers use this value to draw up optimal or rational decision or selection plans.

Because of the complexity of naval weapons systems, the models that are constructed must be somewhat simplified, and the correctness and reliability of the computed results is limited. Moreover, theoretical and experimental studies must be made in order to further improve existing methods. But this method helps decision-makers to decrease errors that could easily arise from immediate experience and to make more scientific and more rational decisions.

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Systems Engineering for Military Command, Control

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[Article by Liu Kejun [2692 0344 0193], National Defense Scientific and Technical University: "Systems Engineering for Military Command and Control"]

[Text] I. Introduction

Man is the most intelligent of creatures, with a "conscious dynamic role." When people engage in collective activity in the three great revolutionary movements of class struggle, production struggle and scientific experiment, to arrive at their common objective they must have various types of command and control processes. In class society, war is the highest form of class struggle, and its command and control is of particularly great importance. Military command and control naturally becomes the focus of discussion of command and control, and as a result of the rapid development of science and technology, the area taken in by military command and control is expanding steadily, and it has extensive influence. Its theoretical development has also stimulated the development of information science. Its engineering implementation is the main field of activity of systems engineering. Its theoretical and engineering accomplishments will inevitably stimulate engineering science to mature and gain in vigor.

The famous ancient military writer Sun Zi wrote in his book on war: "He who knows the other side and knows himself will be in no danger even in a hundred

battles." Chairman Mao has also taught us that "The commander uses all possible and necessary methods of reconnaissance, then subjects the resulting information on the enemy's situation to examination in which he eliminates the nonessentials and incorrect information and retains the essentials and the true information; he then makes inferences about the essential situation, after which he adds to it information about his own situation, weighs the two sides against each other, arrives at a judgment, makes decisions and develops his plans." Thus it is necessary to discover the enemy's pattern of operations and use it as a basis for determining one's operations. The commander always needs timely, correct information on the actual strength of the two sides and the status of operations, and he needs a rapid, reliable method of transmitting his commands to his subordinate units. This can be considered to have been one of the key factors in successful military campaigns for the past 1,000 years. As a result of the extremely rapid development of science and technology since World War II, there have been great changes in the range, speed, precision and lethality of weapons systems. The concepts, methods, equipment and techniques of military command and control have undergone a corresponding transformation. This fact requires that modern military command and control systems have high reliability and survivability, good security and fast, precise maneuverability. If the capabilities of military command and control systems were unable to keep up with modern warfare, the results would obviously be serious, even unthinkable. Accordingly, they have already come to occupy an unprecedentedly important place in defense work, and in addition have come to be one of the key problems in determining whether strategic nuclear weapons can be effective. The technically advanced nations of the world already are energetically developing these systems. This focusing of scientific and technical knowledge on military command and control is considered to be the third revolution in military affairs.

Military command and control is an information processing procedure which provides an internal data flow up to the point of decision-making and an external command flow, transmitting orders. It does everything possible to assemble the elements involved in the making of decisions and to convert them into the most suitable form of presentation for decision-making use by the commander, as well as rapidly, correctly and reliably transmitting the commander's orders in implementation of his decisions. When these orders are being carried out, there will inevitably be new changes in the situations of the two sides. For more effective command and control, it is necessary to report these changes to the commander in timely fashion so that he can make new decisions based on them. Accordingly, this is a repeated, cyclic process. Military men all understand that "speed is of the essence in military affairs"; the faster the reaction time of this cyclic process the better. The speed of intercontinental ballistic missiles, the destructiveness of nuclear warheads and the existence of computerized military command and control systems require that the time needed to make decisions be short and that response be rapid. For example, if an aggressor suddenly attacks our country from a ballistic missile submarine or from the borders, we will have only about 10 minutes' warning, so that we must be able to react quickly.

Because we are a socialist country, our government has repeatedly declared to the world that under no conditions will China be the first to use nuclear weapons, but that it will respond effectively if attacked. Our country's current

economic base has dictated that our strategic nuclear weapons cannot match those of the United States and the Soviet Union in numbers. In order to obtain a suitable and relatively precise capability for dealing with modern warfare and making a suitable response, we need to use advanced scientific and technical achievements to equip our military command and control systems so that they can aid the commanders in dealing with such aspects of warfare as confusion, lack of clear information, and uncertainty, strengthen organization and reliability, and enable our commanders to: (1) monitor closely the situations of the two sides and their development; (2) react quickly to alerts and threats; (3) dispatch the relevant units in timely fashion and carry out battle plans; (4) evaluate offensives, attacks and damage; (5) following a nuclear attack, to reorganize and command the forces; and (6) in protracted war, to manage the theater of operations; this will allow the commanders to bring their subjective activism into play in the objective situation and win resounding victories.

The foregoing focuses on strategic weapons, but at the tactical level too, military command and control systems are extremely important. They are used to elaborate combat plans, to direct combat and to provide dynamic information and strength assessments on the two sides in the battle zone. They provide a weapons and firepower control capability, process information from observation and communications facilities, and maintain communications with friendly force elements. Because modern science and technology focus on military affairs, the capabilities of military weapons systems are extremely great. When the ground forces are engaged in combat they are supported by naval and air forces, producing rapidly-changing three-dimensional combat in which the units have high maneuverability, and accordingly it is critical that the commander be equipped with a modern military command and control system.

II. Main Scientific and Technical Areas Involved

Observation and communications facilities allow timely insight into changes in the objective world. Data processing equipment has greatly improved the power and speed of processing of information and data on the objective world. These factors have greatly aided the commander's decision-making process. We may conclude that in technological terms, communications equipment and computers provided the material basis for the transformation in military command and control. Human behavioral science provides the commander with the biological conditions and reaction capabilities to master, operate and utilize this technical equipment and thus enables him to utilize it better. Communications, computers and people are the three basic factors of command and control; systems theory organically and harmoniously combines these three factors to achieve its objectives. The greatest influence is exercised in this field by: (1) microelectronics and large-scale integrated circuits; (2) digital information transmission systems; (3) ultralow frequency, very low frequency, microwave, laser, satellite and other communications facilities; (4) computers, particularly microcomputers, large-size computers, computer networks, distributed data processing and advanced teleprocessing techniques; (5) displays and intelligent terminals; (6) operations research, decision theory and signal processing, involving fast recognition and detection, determination of importance and implications, presentation of a variety of responses and estimation of their consequences; (7) modular systems design theory; (8) the principles and methods of systems engineering; (9) military command theory.

A. Communications

The primary concern here is how to use the various scientific and technical achievements described above in just the right way and to make integrated use of all types of communications facilities to assure that even in a nuclear war a free flow of military command information can be maintained.

B. Computers

In addition to meeting requirements regarding information capacity, reaction time, man-machine interface, time-sharing operation, distributed information processing and shared communications access it is also necessry to take full account of reliability, which is the most important factor in whether computers can be used in military command and control systems, and which can be improved by various measures. For example, it is possible to use backup techniques such as redundant machines and spare parts, modular interchangeable design, maintenance and self-diagnosis techniques, automatic software diagnosis and testing and the like. Suitable attention must also be devoted to the information processing procedures in command and control, to some basic laws and principles regarding the computer used by the commander himself, to the commander's and operator's requirements and the ways of implementing them on the computer, to the computer's relationship to the entire system and its various elements, and to the use of computers to simulate and test command and control problems.

The main requirements affecting computer hardware configurations are speed, capability of simultaneous operation, reliability and cost. All new computer technologies have been utilized to assure that response time for the commander's information requests will be less than 3 seconds. If this requirement cannot be met, perceptual effectiveness will be decreased. At present, the weak link is input-output equipment.

As military command and control networks continue to expand, the commanders often need to review certain key summary data quickly and to review past and expected information on a real-time basis. This requires that the various levels of storage equipment, with their various speeds, be well coordinated so as to achieve maximum cost effectiveness. It should be borne in mind that different types of information have different access probabilities. For example, information whose access probability is about 90 percent accounts for only 35 percent of all information. By studying such laws and by rational design it is possible to bring the access speed of all information close to that of the fastest large storage devices in the system. As the amount of fixed reference information to which access is desired increases, laser and other mass storage equipment can be used. In addition, thorough use should be made of developments in microelectronics and integrated circuitry, and time sharing operating systems and communications satellite computer networks should be used in order to make thorough use of computer resources and improve overall system capabilities.

2. As regards computer software, because of the complexity reflected by military command and control systems, it is generally necessary to treat

programs and operating systems as a unity in order to thoroughly mobilize the capabilities of all components of the system, so that the commander need only specify the system operating state, check its correctness and make his final decision, thus minimizing the effort that must be expended by the operator and the commander. When a final decision is being made, the problems being considered are very complex, and accordingly, the complexity of the computer control level must be very great. Obviously it is very important that it be highly automated. Its compilation programs not only require a highly efficient machine language, but also high compilation speed. The languages used ideally should allow the programmer to select features from any level and to select the desired control level as needed. The structures of the computer languages used should be suited to the capabilities of military command and control systems. Because of time sharing and on-line and real-time operation are used in computer networks, the languages used must meet their flexibility requirements. As the complexity of decision-making increases, the concept of programming has been further developed. For example, the user can conveniently organize existing programs on the basis of his problem-solving experience in order to produce the needed software. The hardware can even be adapted to the requirements of the problem-solving software. In addition, military commanders need interactive languages to enable the system hardware to operate effectively and expeditiously on the basis of human intentions. In this context, attention should also be devoted to the problem of automatic input and output of the characters and local dialects characteristic of command and control in our army. Because of the characteristics of military command and control, officers requests are generally dynamic and changing, so that it is very difficult to specify in advance, completely and correctly, all of the command and control capabilities which software should have. Software work must adapt to these characteristics.

To summarize, hardware and software must be effectively coordinated so as ultimately to enable the commander to perform his command function by directly operating the computer, using ordinary language.

3. Behavioral Science

The main subject of study here is the commander's decision-making process. Thorough attention should be given to many characteristics of the commander's decision-making such as its game-like nature, security and the like. Only by studying ways of processing complex information into the most suitable form for presentation to the commander can it support optimal decision-making. In this context, the theoretical basis of systems research, namely operations research and the like, is extremely useful. It helps people seek theoretical models of functioning and optimize them. Much work still remains to be done in effectively using the military thought of famous ancient and modern, Chinese and foreign military experts and of Chairman Mao for the decision process. Because the decision-making process is very complex, it is not enough to rely solely on theoretical analysis: experience must also be used. But the actual combat environment generally is not available, and accordingly simulation and experimental techniques must be used. These are essential tools for developing military command and controls systems. In addition, they are an excellent means for training commanders to operate the system.

Furthermore, attention must also be devoted to the process of information interchange between commanders and the forms in which information is presented, in order to maximize their efficiency. Accordingly, visual and audio equipment should be used in integrated fashion, and in particular more use should be made of information display screens.

Because such new technologies as computers and electronic displays have now permeated military command and control systems, the personnel using them must have the requisite scientific knowledge and operating skill. Frequently, because training cannot keep up with advances in equipment, new systems cannot play their full role, for some commanders develop a tendency to use outmoded but familiar manual command and control methods. The effect of high-level commanders' inclinations in this regard is particularly great. Accordingly, it must be stressed that no matter how advanced the technology of military command and control systems is, all equipment must work to help the commander, because the commander is a key element in the system and the human is the key factor. When developing military command and control systems, it is critical that full consideration should be given to the commander's biological and psychological factors and that he should be enabled to master the relevant new technology and operating methods as rapidly as possible. Otherwise it will be difficult to make the machinery fully perform its function of assisting the commander.

4. Systems Theory

This field is concerned not only with things but also with people. Military command and control systems include many unpredictable factors and the technologies and theories of which they make use are developing rapidly. Accordingly, in order to adapt to these changes, recently the concept of continuous modernization has been developed, making use of modular system design concepts. This not only makes it easy to expand the system in the future, but also makes it possible to change the system's structure in response to changes in environment and use requirements. This type of system design theory is extremely well suited to military command and control systems.

In the past there was a certain overemphasis on the technical design of systems hardware and an underemphasis on the commander's requirements, which led to decreasing effectiveness. We should be aware that in military command and control systems, systems theory must make the person the central factor and organically coordinate the person, the machine and communications into an extremely effective military command and control system.

IV. Conclusion

To summarize, military command and control systems involve a wide range of scientific and technical fields. Some of the relevant theories and experience can be extended to social production and scientific experimentation, such as public safety command and control systems, aviation communications command and control systems, bank management systems, state planning commission management systems, weather forecasting systems, space flight command

and control systems, electronic education control systems, intelligence data reference systems, comprehensive medical diagnosis systems, automated engineering design systems, large-scale enterprise management systems and the like. Accordingly, all technically advanced countries have a strong contingent developing military command and control systems. They are of extremely great importance for promoting our country's four modernizations. At present, our country's technological level still lags considerably behind the world level in this area. In order to work successfully in this area we must create a high-level, centralized leadership structure, utilize systems engineering principles and methods to develop a unified, complete general plan, and develop standardization and universalization plans, so as to speed up the development of our country's military command and control systems and make a suitable contribution to carrying out our country's four modernizations!

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- END -

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2 April 1982

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No. 156

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ECONOMIC BENEFIT OF DEVELOPING SCIENCE, TECHNOLOGY STRESSED

Kunming YUNNAN RIBAO in Chinese 4 Jan 82 p 1

[Article by reporter: "Develop Science and Technology, Improve Economic Benefits; the Provincial People's Congress Says It Wants To Place Science at the Same Level of Importance as Policy"]

[Text] Delegates to the Fourth Session of the Fifth Provincial People's Congress said in group discussion that the evaluation of the achievements of science and technology in serving economic buildup noted in the administrative report by Governor Liu Minghui [0491 2494 6540] was correct. To hasten the progress in building the four modernizations in our province, we should place science and technology at the same level of importance as policy.

Delegate Li Peichu [2621 1014 0443] of the Youngsheng County Agricultural Science Institute said: Practice shows that the development of agricultural production relies on: 1) policy, and 2) science. The Zhongzhou Brigade of Liangguan Commune, Yongsheng County, at one time produced high yields of food grains. Later, it neglected scientific planting for a time, and in 1980, its unit yield of paddy rice was only a little over 800 jin. Last year, with the help of the county agricultural science institute, the whole brigade popularized the two superior varieties of zhu hong nian and xue nong No 1, and it implemented the methods of cultivating seedlings under thin plastic sheets, applying chemical fertilizers in the medium soil layer, and applying fertilizers in the surface water layer. Scientific management was carried out from planting to harvesting. While the production cost did not increase, high yields of paddy rice were realized. The average per-mu yield reached 1,024 jin, a net increase of 141 jin over 1980 or 16 percent. Delegate Yang Zaipei [2799 0961 1014] of the Lingchang delegation said, the Gundunzai production team of Hetang Brigade of Mengpeng Commune, Zhengkang County, signed a technical and joint production contract with the agricultural technology station of the county agricultural science institute at Mengpeng Commune and planted scientifically. The total yield of paddy rice reached 187,000 jin, a net increase of 60,848 jin over 1980. The average per-mu yield increased from 368 jin to 545 jin. Scientific planting produced rich results and attracted the enthusiasm of the broad masses of farmers to learn and use science.

Delegates from the industry, transportation, and capital construction fronts also mentioned during the discussion that in implementing the principles of national economic readjustment, scientific research institutes (laboratories) operated by factories have served actively to hasten the development of industrial production and welcome results have been achieved. Delegate Mai Weiling [7796 0251 7792], head of the Design Research Institute of the Yunnan Optical Instruments Plant, said: In the course of readjustment of the national economy our plant was encountering the difficulty of a serious lack of production tasks. The party branch committee at the plant ordered the scientific research institute to develop new specifications for some new products and new varieties according to changes in the market. A group of products suited for marketing was developed and manufactureed, thus promoting the development of production.

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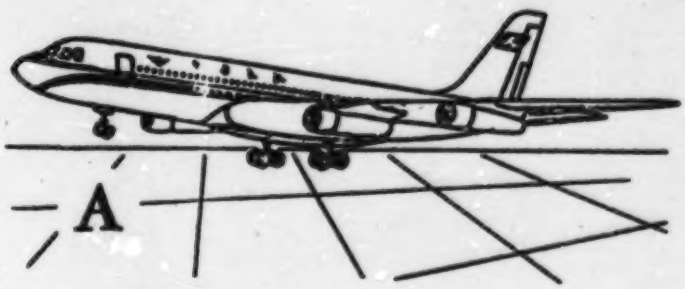
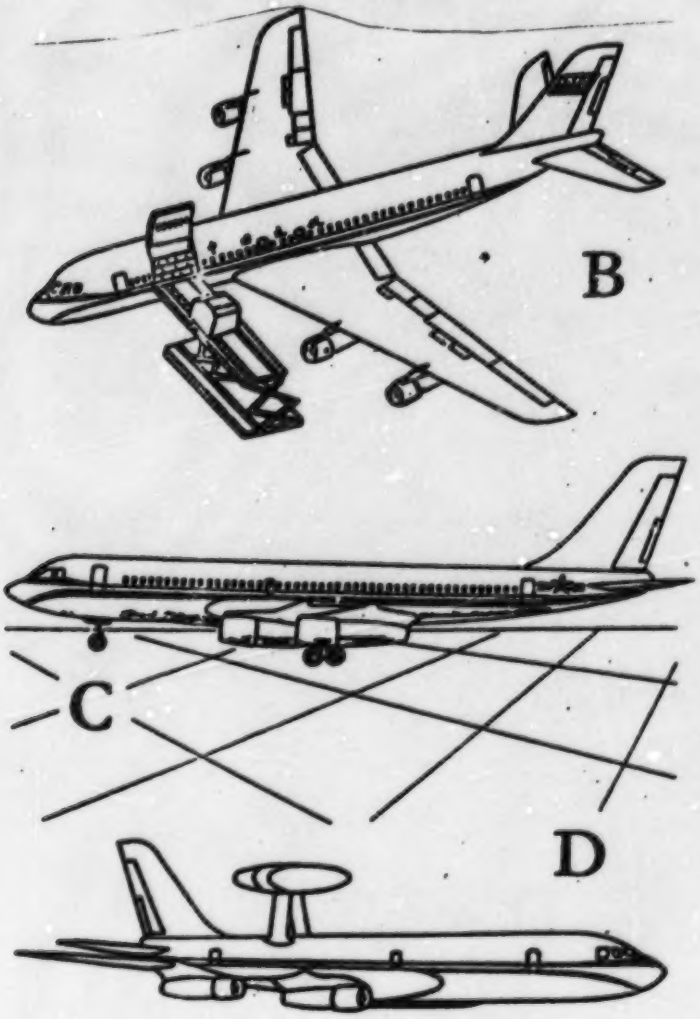
Y-10 COULD SERVE IN CARGO TRANSPORT, EARLY WARNING ROLES

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3, Mar 82 p 4

[Text] If the Y-10 goes into service it may have a wide variety of roles. In addition to its use as a passenger aircraft, it can be modified to become an ambulance aircraft (A). In this configuration, it can transport 110 litter patients and 7 medical personnel. It may also be used as a passenger-cargo carrier.



(B). In this mode, its maximum load is 35-40 tons in the form of 12 containers or 7 jeep-type vehicles. When modified as a military transport (C), it can carry a reinforced company of 160 men with their weapons. Still another application is as an early warning aircraft (D).



CSO: 4008/122

GUIDELINES FOR CONSULTING SERVICES RECOMMENDED

Shanghai WEN HUI BAO in Chinese 3 Dec 81 p 2

[Article: "Organization and Leadership in Scientific and Technical Consulting Services"]

[Text] On 5 November, this newspaper published a letter from ten technical personnel of a design academy in the city entitled "What's Wrong With Doing Spare-Time Design Work for Plants?" and one entitled "Notes on a Reporter's Investigation."

The publication of these two letters provoked a considerable response in the research and design departments and industrial enterprises, and called forth differing opinions regarding the correct way of handling scientific and technical consulting services, the way to bring the enthusiasm of scientific and technical personnel into play, the best ways of reorganizing labor discipline and enterprise management and the like. The differences of opinion reflected some differences in understanding of the relevant regulations and procedures in this area and the fact that some of the regulations and procedures themselves are imperfect; in addition, in some cases new situation and problems with which we have insufficient experience have arisen and must be further investigated.

Scientific and Technical Consulting Services Are Necessary for Economic Construction

The provision of scientific and technical consulting services is an implementation of the policy that science and technology must serve economic construction, and is an important way of stimulating the development of science and technology in coordination with the economy and society. Many universities and research institutes in the city have already begun providing technical consulting services. According to incomplete statistics, in the last 2 years this city's municipal, district or county scientific and technical societies have performed scientific consulting services in more than 2,000 cases, principally including: provision of scientific and technical schemes and technical substantiation for the relevant departments' or localities' development programs, plans and construction projects, and for comprehensive resource development; provision of technical and economic information, technical forecasting and market forecasting to relevant departments, localities and industrial

industrial and mining enterprises; organization of key technical efforts and consultation on technical renovation for industrial and agricultural production units; and the provision of technical consultation to scientific and technical management departments regarding evaluation of scientific and technical results, their dissemination, and exchange of experience concerning them. The practice of scientific and technical consultation has made an excellent contribution to the four modernizations. In 1979, the Xiexin Woolens Mill in this city carried out an extensive reproduction project with state investments (including some foreign compensatory trade funds), but the program experienced difficulty because it could not solve the key problem of wastewater treatment. The plant invited six or seven design units to submit designs, but for various reasons the designs were not received. Subsequently, with the assistance of the Jing'an District Scientific and Technical Society, it solved its problem through scientific and technical consulting services. The city currently has many medium and small sized plants which wish to carry out technical renovation like that at the Xiexin Woolens Mill but lack the technical manpower; the problem is particularly acute in the light industry and textiles system. Some of the plants require small changes but are not capable of making them. Slicing is still done by hand at one Chinese pharmaceuticals plant, resulting in many occupational injuries; the plant wishes to provide protective equipment but is incapable of doing so. The newly emerging scientific and technical consultation services still have not attracted serious attention from all relevant quarters, and as comrades at the Xiexin Woolens Mill say, "When living services are inadequate (e.g. when food and clothing are hard to get) people sympathsize but when technical services to industrial production are inadequate, it's hard for people to symphasize." This makes it clear that scientific and technical consultation services are presently far from sufficient and that they must be enthusiastically encouraged and given positive support so that they can develop more extensively.

Scientific and Technical Consulting Services Must Have a Specific Scope

Naturally, scientific and technical consulting services must have a specific scope. This city's experience in the past 2 years indicates that they should involve the provision of technical substantiation or technical design for medium and small-scale process and product innovations. Because surveys for capital construction and construction design involve stringent technical and quality requirements, the regulations of the relevant state departments do not permit design by individuals or spare-time design work by technical personnel, nor do they permit uncertified units to perform design work. Individual construction units may rely on their own technical manpower or on scientific and technical consulting and technical services for surveys and design for some non-capital construction projects involving renovation or modernization, technical measures, major overhauls and various types of maintenance projects, they must intensify management and stringently assure quality.

Technical Consultation Services Must Be Carried Out Under Suitable Leadership

Scientific and technical personnel's use of working time or spare time to participate in scientific and technical consulting activities, provided that they have performed their regular job responsibilities, can give they them a wider scope for the use of their technical skills and concentrate the

utilization of dispersed "excess brain power," which benefits the four modernizations and all of society and accordingly should be encouraged; but these activities must be carried out in organized fashion and with leadership. The ten design academy technical personnel had participated in the design of the process equipment for the Xiexin Woolens Mill's wastewater treatment process at the invitation of the Jing'an District Scientific and Technical Society and had helped the plant solve a difficult production problem: such activism is good. But they failed to make a report to the leadership of their own unit so that it could centrally organize their work, which was a deficiency. The Jing'an District Scientific and Technical Society failed to contact the technicians' organization before issuing the contract to them, which was a failure to go through the proper procedures. Jing'an District Scientific and Technical Society should, first have discussed the technical consulting services project with the design academy and secured the agreement of its leadership, and the design institute and the Xiexin Woolens Mill should have signed a contract, thus assuring that all procedures were compiled with. In the future, when scientific and technical consulting services are provided, the scientific and technical society generally should not act as a contracting organization, but should establish close relations with the relevant scientific research units and major specialized academies, gain their support, and let them be the parties to the contract; the relevant scientific research institutes and major specialized academies should treat technical consulting services as part of their work, actively support the work of the scientific and technical societies, and help the industrial enterprises solve their problems. This kind of activism on both sides will enable scientific and technical consulation services to be performed better.

Regulation Procedures Should Be Worked Out to Provide Guidance

According to relevant regulations of the municipal government, when enterprises under ownership by the whole people or under collective ownership within or outside the city request employees of sister organizations with technical or specialized skills to carry out equipment overhaul and installation, to provide technical guidance, to furnish design or process data or to train technical personnel, they must follow the requisite organizational procedures in bringing up the subject and must sign an economic contract; where possible the relevant enterprises should give them active support. Although this regulation primarily refers to employees of industrial enterprises, until specific unified regulations and procedures are in existence, the provision of scientific and technical consulting services also should be carried on in compliance with them. This will prevent contradictions with the reorganization of labor discipline and enterprise management which are currently under way. As regards compensation to scientific and technical personnel taking part in the provision of consulting services, we have learned that when the city and district scientific and technical societies carry out scientific and technical consultation work, most projects are done free of charge, and compensation is provided for only in a small number of projects, with a certain proportion being paid to the scientific and technical personnel. This is compensation for the labor expended by these personnel and is similar to the contribution fee paid by news and publishing organizations and the stipend paid to instructors by organizations hiring them to teach courses. It embodies the principle of distribution according to labor. The current problem is that there are no

unified standards for this type of compensation. It appears that regulation procedures are needed to govern the scope of scientific and technical consulting activity, the methods and procedures for organizing it, compensation to the scientific and technical personnel for their work and the like, and accordingly we suggest that the relevant departments study the situation and draw up such procedures to provide guidelines, to promote the development of scientific and technical consulting work more effectively and to aid in the development of the four modernizations.

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REGULATIONS FOR MACHINE-BUILDING STANDARDIZATION ISSUED

Beijing BIAOZHUNHUA TONGXUN [STANDARDIZATION JOURNAL] in Chinese No 6, 1981 pp 4-5

[Article: "State Machine-Building Commission Issues Regulations on Strengthening Standardization"]

[Text] The State Machine-Building Commission accords great importance to standardization work, and in order to improve it as part of readjustment, it has issued ten regulations for strengthening standardization work, which were distributed this June to the relevant departments of the State Council and of the provinces, municipalities and autonomous regions for conscientious implementation, with the requirement that the localities and departments draw up specific procedures for strengthening standardization work in accordance with the spirit of the regulations. The "State Machine-Building Commission Regulations on Strengthening Standardization Work" state the following:

Standardization is an important means of organizing the development of modern production and implementing scientific management. Standardization work is an important form of work on the technical base for the entire production structure and for improving economic effectiveness and the quality of enterprise management.

Standardization work in the machine-building industry has made its greatest achievements in the last 2 years. But there are still many problems. The relevant departments do not sufficiently recognize the importance of standardization and do not accord it sufficient importance; standards management and research organizations are not functioning effectively; there are no normal channels for reimbursement of standardization expenditures; the contingent of scientific and technical personnel for standardization is weak; the development and revision of standards is proceeding slowly; because responsibilities are not made clear, standardization is not effectively implemented or strictly overseen; and specialized standards are few in number and are not centralized. These problems are having a serious effect on specialized production and on technical and economic results in the machine-building industry.

Standardization is an extremely important basic activity, and in order to effectively strengthen standardization work in the context of readjustment, we establish the following regulations:

1. The relevant departments must strengthen their leadership of technical standardization work and must include standardization as a major item on the agenda. Deputy ministers and deputy directors overseeing scientific and technical work in the various departments must resolve to make a conscious effort to carry out technical standardization. They must conscientiously implement the "People's Republic of China Regulations on Standardization Management"; under the leadership of the State General Officer of Standards and in keeping with their own specific conditions, every half year they must carry out one inspection of technical standardization work throughout their areas of competence and must submit one brief written report on the drafting and implementation of standards to the State Machine-Building Commission.

2. The technical policy for standardization must be thoroughly carried out, and standaridzation work must be included in the readjustment plan for the machine building industry. The readjustment plan coordinating groups for the various industrial branches under the leadership of the State Machine Building Commission must treat technical standardization work as a major undertaking; in cooperation with the State General Office of Standards, and relying on the relevant members of the State Technical Committee on Standards and the units or organizations designated as responsible for standardization, they must draft technical standards for the various industrial branches. The departments must assign manpower to the drafting of state standards and special technical standards and must gradually revise existing technical standards as special standards. When the state standards or special standards have been drafted and issued, the various branches of industry must immediately act in accordance with them.

3. The relevant departments must produce a practicable technical standards drafting plan this year and organize the relevant research units and enterprises for a major effort to complete drafting of the main technical standards within approximately 5 years. Before drafting the regulations, they must, under the unified coordination of the State General Office of Standards, draft a standardization system table as a reference for drawing up the regulations. They must first draft integrated, basic technical standards. Already-drafted technical standards (state standards of departmental standards) must be analyzed and revised. Following a stocktaking, by the end of August 1982 they must designate which standards which are usable, which are usuable after revision, and which should be abandoned. All standards drafted in the future must all have a specified term of validity; every 3 to 5 years, standards must be reviewed and either affirmed, revised or abolished. The status of standards drafting or revision should made one of the indices by which enterprise or research institute plan fulfillment is evaluated.

Active cooperation should be given to the State General Office of Standards in the drafting of state standards.

4. The departments must see that standardization management organs (offices or bureaus) and research organs (in general, a ministry should have a standards research institute and a general office should have a standards research office) are operating effectively. They should have competent, dedicated leaders and should be sufficiently well staffed with specialized technical personnel who have some practical experience (dispersed standardization

technical personnel must as far as possible be returned to their home units), and everything possible must be done to maintain personnel stability. The standards engineers should account for 1 to 3 percent of total number of technical personnel in each unit (plant or research institute), with a higher percentage in units with designated responsibility for standardization work. An active effort must be made to improve the working conditions of standards research organizations. In order to speed up the work of drafting and revising standards, the departments may organize existing technical personnel in their subordinate units to take part in standards drafting work and may undertake the appropriate personnel, organization and task assignment measures. Standardization engineers fall within the ranks of scientists and engineers, and must receive commensurate treatment.

5. The relevant departments must choose key research institutes and enterprises and must make maximum use of available equipment and personnel in the specialized responsible organizations of the standards and metrology system to and install the necessary testing equipment and instruments in order to make them into evaluation, examination and testing centers for products of the various industrial branches. The enterprises too must be supplied with suitable testing equipment so that they can conduct strict inspection of their own plants' products in accordance with technical standards. The expenses for this work should be handled as expenditures for technical measures.

6. In drawing up the technical standards, active use must be made of international standards and progressive foreign standards; and account must be taken of the country's resources, energy conditions and current industrial and technical standards, so as to assure that the standards are technically advanced, economically rational and safe and reliable. The departments should send comrades engaged in bona fide standardization work to participate in conferences of international standardization organizations. An active effort should be made to enf import, translate and publish and test and certify* international standards, and international standards and commonly-used foreign technical standards should be conscientiously investigated and actively adopted.

7. The work of drafting technical standards should be involved in the departments' five-year scientific and technical development programs and annual science and technology plans and in the periodic assignments that are handed down. Expenditures for development and testing of important standards should be handled as scientific research expenses. Application should be made to the State General Office of Standards and the cognizant departments for supplementary funds to cover the cost of drafting and revising standards. Technical standards which have been approved should be treated as scientific research results and are eligible for awards in accordance with the applicable regulations.

8. Standardization work related to technology import should be intensified. Technical standards (which generally include technological advances) are an important component of the importation of advanced foreign technology. Standardization should be carried on during investigation, negotiations for, translation, and practical assimilation and production of imported technology. The cognizant departments should organize unified collection, translation and analysis of international standards and relevant enterprise standards. Provided

that it can be assured that the quality of the imported technology and product quality will not be lowered, active use should be made of this country's national and special standards (departmental standards) to carry out effective substitution or experimental development of domestically produced materials. Otherwise it will be necessary to adopt imported standards (foreign national or enterprise standards) and international standards.

A major effort must be made to absorb imported advanced technical standards and to continuously raise our country's standards. All cognizant departments which import technology should take responsibility for organizing the coordinated supply of standardized, commonly-used spare parts and components for imported technology.

9. Technical standards for electromechanical products intended for export must be revised or newly drafted and strictly implemented.

In the case of electromechanical products which are already on the international market or are about to enter it, our country's existing standards should be revised in accordance with international standards or commonly-used advanced foreign technical standards so that they are not inferior to the prevalent foreign products in capabilities and quality, are interchangeable with them, and are adapted to the requirements of the international market, so as to increase their competitiveness. If it is unsuitable or temporarily impossible to use unified standards for both exported and domestically-sold products, the departments should, in cooperation with the relevant branches of industry, organize expeditious drafting of temporary special standards for export products and report their proposals to the State Machine-Building Commission and the State General Office of Standards. When enterprises produce electromechanical products for export, they must strictly observe the export technical standards to assure the quality of the export products.

10. When the production sections of the relevant departments organize production, they must conscientiously implement all technical standards. Technical standards that have been issued and are in effect have the force of law, and all products which do not comply with them are substandard. No products which have not been produced in conscientious compliance with the various technical standards may be rated as top-quality products or may be eligible for quality honors and material awards. All new electromechanical products must be produced in accordance with the "Procedures for Inspection and Management of Standardization of New Electromechanical Products."

The production authorization regulations which are about to be drafted must specify that production of any products not produced in accordance with the state standards or special standards (departmental standards) must cease, and that production authorization certificates must not be issued for them. The funcational organizations overseeing technical standards are the quality management departments of the departments. The departments should also designate certain evaluation and testing centers to carry out standards inspection of relevant products and to report their results in the proper publications.

8480
CSO: 4008/97

SHAANXI GOVERNOR PROPOSES TO STRENGTHEN APPLIED S&T RESEARCH

Xian SHAANXI RIBAO in Chinese 31 Dec 81 p 1

[Article: "Yu Mingtao [0060 2494 3447] Proposes To Strengthen Research in Applied Science and Technology and Popularize Achievements of Scientific Research"]

[Text] Provincial Governor Yu Mingtao [0060 2494 3447] said in his administrative report: The scientific and technological, cultural, educational and public health fronts have mobilized the enthusiasm of the broad numbers of intellectuals and the masses of workers by further implementing the party's various policies and have realized new achievements.

Yu Mingtao said: the Scientific and technological forces have concentrated their efforts on readjustment, insured the key points, strengthened the study of applied science and technology, and popularized the achievements of scientific research. Last year, 409 important scientific and technological achievements were realized. Among them, two received the national invention award, 134 were cited by the provincial people's government, and 105 were popularized. This year, over 200 more scientific and technological achievements were realized. The scientific research agencies have restored and established normal order through reorganization. Now, there are already 68 associations and societies of various types with a membership reaching more than 22,000 persons. Academic exchange activities have further developed. Over 7,750 academic papers were exchanged, some of a relatively high standard. As of the end of September, over 66,000 various technical cadres were evaluated and promoted for good performance, and the enthusiasm of scientific and technical personnel was mobilized.

Yu Mingtao said: education, culture and public health continued to develop. The number of students enrolled in higher educational institutions increased 18.8 percent over last year. The number of colleges on television, workers universities and correspondence colleges reached 44, with a student population of over 15,000. The distribution of middle schools and the scale and structure of mid-level education was readjusted. The number of agricultural middle schools and vocational middle schools increased. The quality of education was improved. In public health, reorganization of public health agencies, quality management and control of drugs and medicines,

prevention and control of local diseases, female and child hygiene and health work were strengthened. Planned parenthood realized new achievements. The natural population growth rate basically remained at the originally established 0.9 percent control goal. Culture, physical education, cultural relics, broadcasting, television, journalism, and publishing all realized new developments. Tourism also developed very quickly. From January to November, the number of foreign tourists increased by more than 70 percent over the same period last year.

9296
CSO: 4008/91

REMOTE CONTROLLED AIRCRAFT FOR MINERAL PROSPECTING TESTED

Xian SHAANXI RIBAO in Chinese 30 Dec 81 p 1

[Article by Wang Zhenqin [3679 2182 0530]: "Experiment Using an Unmanned Remote-Controlled Airplane To Measure Magnetism and Carry Out Mineral Prospecting in Mountain Regions Is Successful for First Time"]

[Text] An experiment using an unmanned remote-controlled airplane for aerial measurement of magnetism and prospecting minerals in mountain regions was successfully carried out recently by the Provincial Geological Bureau in the Shimen Mountain region.

This experiment was conducted from two localities on top of high mountains by remote control "relay." An unmanned geophysics prospecting airplane under the control of telemetric equipment on the ground flew over mountain peaks, and rivers and went straight to the operational zone 11 kilometers from the launching site at 1,500 to 1,800 meters above sea level. After entering the operational zone, control of the unmanned airplane was taken over by the control station in the operational zone. The airplane automatically carried out a planar scanning type parallel telemetric network for aerial telemetry of magnetism, and at the same time, the telemetric data of aerial magnetism measured were accurately transmitted to the ground in a timely way, and the data were displayed in analog form and digital printout and recorded. The three "relay" control experiments conducted this time successfully completed all procedures of relaying, operation and retrieval.

Through this experiment, experimental results of two airplanes and two sets of aerial telemetric systems were also obtained; they successfully obtained decisive and important references for the use of remote-controlled airplanes over most of the Qinbashan region in carrying out various types of geophysical prospecting, aerial photography, infrared remote sensing and meteorological studies, national defense construction, and soil preservation operations.

9296
CSO: 4008/91

BRIEFS

MICROWAVE COMMUNICATIONS NETWORK--Daqing, 19 Mar (XINHUA)--Daqing Municipality has recently completed and put into operation a microwave relay urban telecommunications network with crisscross exchanges. All the equipment used in the network 15 made in China. With microwave relay as primary means of transmission, the network meets the requirements of various telecommunications, including industrial television, data transmission and special control lines [diao du zhuan yong xian 6148 1653 1413 3938 4848]. It has created favorable conditions for conducting closed-ciruit television education and holding television and telephone conference. It will play an important role in improving the production management and control of the oilfield. [Text] [OW192110 Beijing XINHUA Domestic Service in Chinese 1217 GMT 19 Mar 82]

REMOVING TV ANTENNAS--During its struggle against corrosive influences, Kaiping County has carried out propaganda and educational work in depth. The county's party members and leading cadres at all levels have set examples, and extensively mobilized the masses to resolutely implement the higher authorities' directive on taking down the ultrahigh frequency antennas, also known as fishbone antennas, which are used for receiving Hong Kong television programs. By 20 March, a total of 822 fishbone antennas had been taken down, which account for 91 percent of all the fishbone antennas installed in the county. [Text] [HK240653 Guangzhou Guangdong Provincial Service in Mandarin 2350 GMT 23 Mar 82]

CSO: 4008/129

AUTHOR: HUANG Wenxi [7806 2429 3556]
WANG Xie [3769 6200]
XU Xianjin [1776 6343 6651]
SHEN Hongfa [3088 3163 3127]
GUO Juncai [0948 0193 2088]
MA Caixin [7456 2088 9515]

ORG: All of Wuhan College of Construction Materials

TITLE: "On Heat Transfer of the Suspended Ebullition State"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, 10 Feb 82 pp 2-7

ABSTRACT: Suspension preheated kilns began to appear in the 50's and the way heat is transferred between the raw material in the cement kiln and the air current has thus been basically altered. The material is in a suspended state to increase greatly the area and the coefficient of heat exchange. The production of the kiln increases and the heat consumption of the clinker decreases, from the 1300-1500 Kcal./kg of clinker (wet method) to 725-850 Kcal./kg. Moreover, the useful life of the refractories is lengthened while air pollution is reduced. This paper explains the advantages of this type of modernized kilns, equations for calculating the heat transfer area, the thermal conductivity, and the fluidized bed. There is no mention of adoption of this technology in China, however.

AUTHOR: HE Qiongyu [0149 8825 3842]

ORG: Construction Material Research Academy

TITLE: "Method of Pozzolanic Characteristic Test -- Research on the Application of ISO/R863-1968"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, 10 Feb 82 pp 7-12

ABSTRACT: In China, the lime absorption method is mostly used to test the pozzolanic characteristic of a cement mix, using mg/g to indicate activity. This method in fact does not reflect the characteristic of the cement added. In 1977, the academy in formulating standards of cement and coal ash in concrete, recommended the international standard of using the ISO/R862-1968 method to determine the pozzolanic characteristic of portland-pozzolana cement. Since 1980, in the process of revising the standards for pozzolanic materials, the author and colleagues have carried out more studies on the ISO method. Combined with the concrete condition of cement analysis in China, in the research process, the $KMnO_4$ method was replaced by the EDTA method to determine CaO. As a part of preparation for general extension of the ISO method, this paper introduces its theory, the test procedure, and an evaluation of its test results.

6248
CSO: 4011/36

AUTHOR: CHENG Xi [4453 1585]

ORG: Chairman, Construction Economics Committee

TITLE: "Speech at the National Construction Industrialization Experience Exchange and Scientific Discussion Meeting"

SOURCE: Beijing JIANZHU JINGJI YANJIU [RESEARCH IN CONSTRUCTION ECONOMICS] in Chinese No 1, 15 Feb 82 pp 2-11

ABSTRACT: The National Construction Industrialization Experience Exchange and Scientific Discussion Meeting, under the joint auspices of the National Bureau of Construction and the Chinese Society of Architecture Construction Economics Committee, was held in Changzhou City of Jiangsu Province on 11-18 Nov 81. This speech was delivered on the 8th day of the meeting. The author briefly reviewed the history of China's attempt at industrializing since the 50's, through the decade of disturbance, and since 1976. Lessons learned from the recent years are summarized as being that in order to industrialize it is necessary to adopt suitable technologies gradually according to local conditions and it is necessary to emphasize the construction of residential dwellings. With regard to the future, the author believes that (1) There must be a firm determination that industrialization is the direction of development for the future; (2) There must be a reform of the brick and mortar concept and in its place, such new building systems as large modules, large boards, and blocks must be perfected; (3) Various types of prefabricating plants must be reorganized to develop commercialized production of large construction parts and structural members; (4) The relationship between standardization and variety must be correctly handled to create new architectural styles;

[continuation of JIANZHU JINGJI YANJIU No 1, 1982 pp 2-11]

(5) Strengthen production management and develop comprehensive economic analyses; (6) Strengthen scientific research to serve the development of construction industrialization; (7) Strengthen leadership and planning to improve the level of construction industrialization.

AUTHOR: WU Luoshan [0702 3157 1472]

ORG: None

TITLE: "Strengthen Research on Construction Economics to Improve the Economic Benefits of Construction"

SOURCE: Beijing JIANZHU JINGJI YANJIU [RESEARCH IN CONSTRUCTION ECONOMICS] in Chinese No 1, 15 Feb 82 pp 37-39

ABSTRACT: Following the example of Premier ZHAO Ziyang's report of governmental work delivered at the 4th plenum of the 5th People's Congress, the author presents his viewpoints concerning ways of improving the economic benefits of the construction industry. On the basis of concrete conditions, after the leftist errors have been rectified, the theoretical research in construction economics should pursue the definition of the subject, the contents of construction industrialization, and the fact that as an independent department of material production, the business of construction is merchandise economics. In summarization, it is urgent that solutions must be found for the following: (1) Problem of evaluating construction; (2) Problem of evaluating 3-waste utilization, and land and energy conservation; (3) Problem of calculating the economic benefit of shortening the workday; (4) Problem of evaluating investment cost of useful life [of structures.] (5) Problem of predicting effects of labor, material, and resources development on cost; (6) Problem of calculating cost distribution between land and engineering projects in terms of highrise buildings.

AUTHOR: LI Huiru [2621 1920 1172]

ORG: Institute of Economics, Chinese Academy of Construction Science Research

TITLE: "On the Problem of Energy Conservation in Construction"

SOURCE: Beijing JIANZHU JINGJI YANJIU [RESEARCH IN CONSTRUCTION ECONOMICS] in Chinese No 1, 15 Feb 82 pp 45-48

ABSTRACT: Energy crisis has become a world-wide problem in recent years. China has had the problem continuously over the past decade. Although the per capita consumption of coal is only 0.6 ton, 2/3 less than the world average, the amount of coal production remains roughly the same as its consumption. According to preliminary estimates, it is not possible to increase the production of energy over a large scale before 1985 while the demands for energy for industrial, agricultural and civilian uses will continue to increase before then. The construction industry consumes about 1/4 to 1/5 of the total energy consumption of the country; therefore, energy conservation of the construction industry is extremely important in resolving the problem of energy shortage. Ways of conserving energy in reducing unit energy consumption for producing construction materials, such as steel, cement clinker, etc. and in designing buildings that are economical to heat, etc. are discussed.

6248
CSO: 4011/31

AUTHOR: PAN Dehui [3382 1795 1920]

ORG: Control Theory Teaching and Research Group

TITLE: "On the Existence of Regular Solution for Equations of the Parabolic Type with Discontinuous Initial and Boundary Conditions"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 1-8

EXCERPT FROM ENGLISH ABSTRACT: In this paper the existence of solvability for the following generalized boundary value problems is discussed.

Let $\mathcal{L}$ be the parabolic differential operator defined in the region $\Omega\times[0, T]$ in an $n+1$ dimensional space and Ω be the bounded region with a bound S in an n-dimensional Euclidean space E_n. The problem of whether there exists a regular solution for the second order parabolic equation

$$\mathcal{L}(u) = \sum_{i,j=1}^{n} a_{ij}(P, t)\frac{\partial^2 u}{\partial x_i \partial x_j} + \sum_{i=1}^{n} b_i(P, t)\frac{\partial u}{\partial x_i}$$

$$+ c(P,t)u(P, t) - \frac{\partial u}{\partial t} = f(P,t) \qquad (1)$$

on $\Omega\times[0, T]$ satisfying the following initial and boundary conditions is taken into consideration.

[Continuation of DONGBEI GONGXUEYUAN No 4, Dec 81 pp 1-8]

If $\varphi(P)$ is continuous at point P, then

$$\lim_{t\to 0} u(P,t) = \varphi(P) \qquad (2)$$

If $P\in\Omega$ (or $P\bar{\in}\Omega$) and approaches the point $Q\in S$ along the conormal of S, then

$$\lim_{P\to Q} u(P,t) = \psi(Q,t) \quad \cdots\cdots\text{(first boundary value problem)} \quad (3)$$

$$\lim_{P\to Q} L_P u(P,t) = \psi_1(Q,t) \cdots\cdots\text{(mixed boundary value problem)} \quad (4)$$

almost everywhere over S, where L is referred to as the operator in §1. Of the functions mentioned above, $\varphi(P)$ is piecewise continuous on $\bar{\Omega}$, and $\psi(Q,t)$ and $\psi_1(Q, t)$ are the arbitrary Lebesque integrable functions with respect to Q over S and also continuous with respect to t. With the aid of both the double layer and the single layer potential functions, these problems can be reduced to the linear integral equations solved with definite conditions including Lebesque integrable free terms. As a consequence, the existence of regular solutions for the problems with interior and exterior boundary values is proved. In this paper the first interior boundary value problems are emphatically discussed in detail.

AUTHOR: QIU Jicun [8002 4949 1317]
XUE Wenya [5641 0795 0068]
LI Xiaoping [2621 1420 1627]

ORG: All of the Department of Mining

TITLE: "The Dispersion of Silica Fine Particles by Acidified Sodium Silicate and Ferric Nitrate"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 9-20

TEXT OF ENGLISH ABSTRACT: $Na_2SiO_3 \cdot 9H_2O$(I), $Na_2SiO_3 \cdot 9H_2O + HNO_3$(II) and $Na_2SiO_3 \cdot 9H_2O + HNO_3 + Fe(NO_3)_3 \cdot 9H_2O$(III) solutions, used as dispersing agents, were tested for their relative dispersion powers acting on fine silica particles in which the dispersing agents II and III were prepared at a pH value of 3. Each of them was added to the fine silica pulp of pH 10.5 regulated by Na_2CO_3 and their dispersion powers were measured by sedimentation. It has been found that the dispersion powers are III > II > I in order. The metallurgical results of direct flotation tests of silicious hematite ore, using tall oil and diesel oil as the collectors for the hematite, are also in the same order (III > II > I). The higher dispersion powers of II and III are attributed to the formation of the protective colloids adsorbed on the silica surface as observed by electronmicroscopic examination. The ζ-potentials of quartz are also measured and considered to be related to the adsorption of protective colloids.

AUTHOR: LI Xirun [2621 6932 3387]
LIN Yunmei [2651 7301 2734]
ZHENG Yutian [6774 7183 1131]

ORG: All of the Department of Mining

TITLE: "An Analysis of the Mechanism of Pin Timbering"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 21-31

EXCERPT FROM ENGLISH ABSTRACT: As an effective safety measure taken to prevent rock falling in roofed tunnels or stopes, pin timbering has been widely used up to the present. Based on the simplification and reformation of the elasticity expressions proposed by J. Dundurs and Flamant, this paper contributes the theoretical formulas for the superimposed stress fields due to pin timbering with a single roof bolt, a group of roof bolts and a roof bolt truss, respectively. The photoelastic experiments presenting the stress distributions in rock masses around the anchored roof bolts have been carried out and their results are compared to the theoretical values calculated by a computer with the above-mentioned formulas, thus explaining the rock suspension mechanism of pin timbering. Such a comparison shows that the explanation of the rock suspension mechanism of pin timbering tallies with the actual situation.

AUTHOR: DU Gang [2629 6921]
DU Hegui [2629 7729 2710]

ORG: Both of the Iron Smelting Teaching and Research Group

TITLE: "On the Evolution of Softening Melting Zones and Their Aerodynamic Properties in a Blast Furnace"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 33-40

TEXT OF ENGLISH ABSTRACT: The temperature field in a blast furnace is one of the decisive factors in both the evolution of softening melting zones and their aerodynamic properties and, moreover, it is closely related to the distribution of gas flow. In this respect, the operating regulation is of significance and affects the distribution of gas flow so as to vary the temperature field in a blast furnace and to be able to form the softening melting zone with different shapes. The operating regulation for the lower part of a blast furnace, such as the air flow control, the tuyere diameter and the length of the tuyere nozzle inserted into the hearth, are particularly considered in connection with the evolution of softening melting zones according to the variation of the gas streamlines within the charge layers determined by the model experiments under different conditions. Furthermore, the functional relation between the permeability index of softening melting zone (ξ/H, i.e., the gradient of gaseous resistance coefficient), the number of coke slits (n) and their

[Continuation of DONGBEI GONGXUEYUAN No 4, Dec 81 pp 33-40]

thickness (h) and width (L) and the voidage of the coke slit (ε) are derived by using the dimensional analysis method with the data of model experiments. It is shown as follows:

$$\xi/H = KL^{0.183}n^{-0.46}h^{-0.93}\varepsilon^{-3.74}$$

The physical meaning of the permeability index ξ/H is qualitatively discussed as well.

AUTHOR: LI Wanxing [2621 8001 5281]

ORG: Antenna Electronics Teaching and Research Group

TITLE: "The NDRF Busy Control System--A Method Adopted to Eliminate the Impairment due to the Capture Effect on the Single-channel, Multi-address, Angular Modulation Communication System"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 41-48

TEXT OF ENGLISH ABSTRACT: A review of the literature reveals that all the single-channel multi-address communication systems usually apply angular modulation and, therefore, the impairment in the communication net through the capture effect is unavoidable. This paper offers a suggestion for eliminating such an impairment--the NDRF (noise detection, main station relaying, follow-up instruction) busy control system. An analysis is made in detail for the NDRF system, especially about the noisiness of the FM demodulator and the principle of noise detection which are expressed by formulas. Experiments show that the theoretical calculations are fairly consistent with their results and the NDRF system can be designed theoretically according to these derived formulas. The suggestion, therefore, shows greater practical value because it is verified that the NDRF can basically eliminate the impairment due to the capture effect on the single-channel, multi-address, angular modulation communication system even though its structure is very simple.

AUTHOR: LI Chunfu [2621 4783 3940]

ORG: Cutting Tools and Measurement Teaching and Research Group

TITLE: "On the Measurement Error and Limit of Acceptance"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 49-66

TEXT OF ENGLISH ABSTRACT: Measurement errors have an effect on the acceptance check for machine parts inspection, thus false rejection and false acceptance take place unavoidably to a certain degree. The probabilities of false rejection and false acceptance vary with the part's dimensions inspected and the different distributions of measurement error, such as the uniform distribution, the normal distribution and both in combination. A group of formulas for evaluating these probabilities is developed in this paper and, based on that, several analytical graphs are plotted to point out the efficient measures taken to reduce the probabilities of false rejection and false acceptance. The probabilities of false rejection and false acceptance, respectively, are expressed as follows:

$$n_A = 2\int_{(\frac{T}{2}-s-A)}^{\frac{T}{2}} \varphi_p(x)\left[\int_{(\frac{T}{2}-s-A)}^{\infty} \varphi_m(y)dy\right]dx,$$

$$m_A = 2\int_{\frac{T}{2}}^{(\frac{T}{2}+s-A)} \varphi_p(x)\left[\int_{-\infty}^{(\frac{T}{2}-s-A)} \varphi_m(y)dy\right]dx$$

where T is the manufacturing tolerance of the workpiece;
u is the measuring uncertainty;
A is a value reduced from the limits of manufacturing dimensions such that the acceptable limit is decided.

AUTHOR: YAO Minsheng [1202 3046 3932]
YANG Naiheng [2799 0035 1854]
YANG Changqing [2799 1603 7230]
XU Chenghai [1776 2052 3189]

ORG: All of the Vacuum Teaching and Research Group

TITLE: "A Reasonable Design Calculation of the Chamber Profile of Sliding-vane Rotary Flow Meters"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 67-76

TEXT OF ENGLISH ABSTRACT: Briefly introducing the principle of operation of the sliding-vane rotary flow meter, a reasonable design of the chamber profile in this kind of flow meter is suggested in this paper with the intention of meeting such technical requirements as higher metering accuracy and less counting loss, wider metering range, less pressure loss, lower vibration and noise, steady rotation and less metering error due to the viscous property of the fluid metered. For the reason given above, the cycloid, taken as a transition curve of the chamber profile connecting two arcs with different curvature radii, is a substitute for the elliptic curve proposed in an earlier paper, thus preventing the impulse due to the radial acceleration caused by the elliptic curve. The theoretical and practical formulas of the chamber profile are shown, and the oscillating angle (pressure angle) λ and

[Continuation of DONGBEI GONGXUEYUAN No 4, Dec 81 pp 67-76]

minimum width of the sliding-vane are also given. Finally, the possibilities for the smooth motion of the sliding-vane and for the use of form milling to manufacture the chamber profile are also discussed.

AUTHOR: LIU Jie [0491 2638]
WEN Bangchun [5113 6721 2797]

ORG: Both of the Mining Machinery Teaching and Research Group

TITLE: "The Bending Vibration Factor of Vibrating Conveyers and Its Application in Design"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 77-88

TEXT OF ENGLISH ABSTRACT: This paper advances a new concept, BVF--bending vibration factor, for the purpose of checking the bending vibration of a vibrating conveyer similarly to checking its strength through a stress calculation in design. The BVF may be expressed as

$$c = |a^*/A|$$

where a^* is the maximum amplitude of the bending vibration and A the amplitude of parallel motion in the direction perpendicular to the axis of the conveyer trough. The allowable value of BVF, which may be applied to judge the reasonableness for designing a vibrating conveyer, is proposed to be smaller than 1/5 ~ 1/4 and no larger than 1/3 ~ 1/2 in general. As for the problem of calculating the natural frequencies and their vibrational responses under the bending vibration for a vibrating conveyer, the transfer matrix method and the finite element method are

[Continuation of DONGBEI GONGXUEYUAN No 4, Dec 81 pp 77-88]

applied to the bending vibrations with single-mass and multi-mass respectively. Subsequently, the source programs of EBVA and EBVB are also made correspondingly with FORTRAN-IV-H. It seems probable that the use of BVF is convenient for checking the bending vibration that usually is a problem in dealing with design.

AUTHOR: WANG Tingpu [3769 1694 3302]
LI Shengzhi [2621 3932 2535]
WANG Hanwen [3769 3352 2429]

ORG: WANG Tingpu and LI both of the Steel Rolling Teaching and Research Group; WANG Hanwen of the Drafting Teaching and Research Group

TITLE: "On the Lateral Force and Optimum Off-centering of the Smaller Roll in Asymmetrical Rolling"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 89-97

EXCERPT FROM ENGLISH ABSTRACT: The asymmetrical rolling of metal studied here means that the workpiece is rolled between two rolls which are significantly different in diameter but rotate with the same peripheral velocity. The principal advantages of such a rolling process are the abilities to reduce the rolling pressure considerably and to save energy.

AUTHOR: CHEN Jiamin [7115 1367 3046]

ORG: Department of Metal Materials

TITLE: "New Formulas for Calculating the Pressure under Forging Reduction"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 99-113

EXCERPT FROM ENGLISH ABSTRACT: New formulas for calculating the pressure under forging reduction in cases of the deformation of cylindrical specimens and the plate with planar deformation are both proposed here. These formulas are derived on the assumption that the approximately simplified distortion-energy condition of plasticity proposed in earlier paper is replaced by the more precise one. In addition, the contact surface is zoned according to the different frictional rules. The values of the pressure under forging reduction calculated by these formulas are more accurate than those calculated by the prevailing Unksov's calculating method based on the assumption of the simplified condition, and it is proved that the latter can make an error even greater than 20 percent. For general cases, i.e., when the specimen is a plate with non-planar deformation, the pressure deforming the specimen under forging reduction may be calculated by use of the "zoned method" proposed, and the results are closer to the measured values. With the charts plotted from the calculated results, such a method renders the calculation of the pressure under forging reduction much more convenient.

AUTHOR: LIU Weijie [0491 0251 2638]
ZHANG Wanxian [1728 8001 7359]
YAN Zhenqi [7051 2182 2790]

ORG: All of the Metals Teaching and Research Group

TITLE: "A Theoretical Consideration of Formation Conditions of Granular Bainite in Microalloyed C-Mn Steel"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 115-124

EXCERPT FROM ENGLISH ABSTRACT: An attempt has been made to semiquantitatively indicate the dependence of the structure of the C-Mn steel bearing microelements V and Ti on the transformation conditions through a dynamic analysis of the formation of granular bainite. This paper offers a concept about the critical conditions of the formation of granular bainite on the basis of experiments and metallographic examinations when the samples were isothermally treated for different times and cooled continuously, i.e., the critical austenite grain size (diameter) d_c, the critical isothermal treating time t_c and the critical cooling rate v_c. They are derived from the fundamental theories of physical metallurgy.

AUTHOR: MA Longxiang [7456 7893 5046]

ORG: Department of Metal Materials

TITLE: "Recent Developments in Material Science and Engineering"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 81 pp 125-144

TEXT OF ENGLISH ABSTRACT: Four problems concerned are briefly discussed.
1. Evolution of material science and engineering.
Starting with the early man-made implements, a historical review of the development of materials is made. As a subject, the evolution of material science and engineering is taken into consideration as associated with the development of materials. Three main fields of modern production of materials and their application are analyzed:
--unceasingly broadening the scopes of variety of materials;
--exploring the properties of various materials;
--developing the forming processes.
The correlation between material research and material application and the correlation of research work between non-ferrous metal and ferrous metal are also briefly stated.
2. Present priorities researched on material science and engineering.
According to the statistical data by Cohen about nine fields of application of the

[Continuation of DONGBEI GONGXUEYUAN No 4, Dec 81 pp 125-144]

influential materials in the United States, a priorities' analysis is given to the recent research projects on the development of variety of materials and their properties and processing methods.
3. New trends of the following research works of material science and engineering:
--fracture mechanism and the controls of microstructure;
--superplasticity;
--shape memory effects of metals;
--superconductive materials;
--composite materials;
--ceramic and glass materials;
--space materials;
--developing metal processing methods;
--corrosion of metal materials.
4. The development of education in material science and engineering:
--a brief historical retrospect;
--fundamental courses of education;
--unbalanced tendencies in education;
--development of education in material science and engineering in China.

9717
CSO: 4009/268

AUTHOR: XIE Bangjie [6200 6721 2638]

ORG: Department of Mathematics

TITLE: "Several Theorems Concerning Self-conjugate Matrices and Determinants of Quaternions"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 1-7

TEXT OF ENGLISH ABSTRACT: Let K be the skew-field of real quaternions. A matrix $A = (a_{ij})_{n\times n}$ over K is called centralizable of the characteristic matrix $\lambda I - A$ can be reduced by some elementary transformations into the following diagonal form:

$$\begin{pmatrix} 1 & & & \\ & \ddots & & \\ & & \varphi_1(\lambda) & \\ & & & \ddots\ \varphi_s(\lambda) \end{pmatrix}$$

such that $\varphi_1(\lambda)|\varphi_2(\lambda)|\ldots|\varphi_s(\lambda)$ and $\varphi_i(\lambda)$ ($i = 1, 2, \ldots, s$) are all monic real polynomials. In this case, the determinant of A may be defined as

$$\|A\| = (-1)^n \varphi_1(0)\varphi_1(0)\ldots\varphi_s(0).$$

In this paper, some theorems concerning self-conjugate matrices and determinants of real quaternions are proved.

AUTHOR: LIANG Xuezhang [2733 1331 4545]

ORG: Department of Mathematics

TITLE: "A New Class of Spline Interpolation Formulas with Equidistant Nodes"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 17-25

TEXT OF ENGLISH ABSTRACT: Making use of the spline interpolation theory introduced by I.J. Schoenberg, in this paper we give a new class of spline interpolation formulas with equidistant nodes. Compared with the class of interpolation formulas using the theorem in Schoenberg's paper, under the circumstances of the same degree of smoothness and algebraic exactness, the degree of our interpolation polynomials is lower and, sometimes, the span of our interpolation basis function is shorter.

AUTHOR: LI Ronghua [2621 2837 5478]

ORG: Department of Mathematics

TITLE: " Generalized Difference Methods for the Two-point Boundary Value Problem"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 26-40

TEXT OF ENGLISH ABSTRACT: Consider the two-point boundary value problem:

$$-\frac{d}{dx}\left(p\frac{du}{dx}\right)=f(x), \qquad u(a)=u'(b)=0.$$

Let $U_h=\operatorname{span}\{\varphi_1,\varphi_2,\cdots,\varphi_n\}$ and $V_h=\operatorname{span}\{\psi_1,\psi_2,\cdots,\psi_n\}$

be trial and test spaces respectively. Then the generalized Galerkin solution $u_h=\sum_{i=1}^{n}u_i\varphi_i$ is the element of U_h which satisfies

$$\sum_{i=1}^{n-1}u_iB(\varphi_i,\psi_j)=(f,\psi_j), \qquad j=1,2,\cdots,n-1, \qquad (*)$$

where

$$B(u,v)=\int_a^b pu'v'dx.$$

The usual difference methods may be derived from the equation (*) by choosing

[Continuation of JILIN DAXUE ZIRAN KEXUE XUEBAO No 1, 1982 pp 26-40]

$$\varphi_i(x)=\begin{cases}1-h_i^{-1}|x-x_i| & \text{on } [x_{i-1},\ x_i],\\ 1-h_{i+1}^{-1}|x-x_i| & \text{on } [x_i,\ x_{i+1}],\\ 0 & \text{else where;}\end{cases}$$

$$\psi_j(x)=\begin{cases}1 & \text{on } [x_{j-\frac{1}{2}},x_{j+\frac{1}{2}}),\\ 0 & \text{else where,}\end{cases}$$

where

$$x_0=a<x_1<\cdots<x_n=b, \quad h_i=x_i-x_{i-1}, \quad x_{i-\frac{1}{2}}=\frac{1}{2}(x_{i-1}+x_i).$$

We define the generalized difference methods by taking φ_i to be the usual Hermite spline functions, and

$$\psi_j(x)=\psi_j^{(1)}(x)=\begin{cases}(x-x_j)^1/1! & \text{on } [x_{j-\frac{1}{2}},\ x_{j+\frac{1}{2}}],\\ 0 & \text{else where.}\end{cases}$$

The error estimation is investigated for the case φ_i being taken as cubic Hermite splines and $\psi_i=\psi_i^{(0)}$, $\psi_i^{(1)}$. The accuracy and computational economy of the generalized difference methods have been shown by theoretical analysis and a numerical example.

AUTHOR: LUAN Wengui [2948 2429 6311]

ORG: Computing Center, Chinese Academy of Sciences, Beijing

TITLE: "The Estimates of Continuous Dependence of Cauchy Problem for Differential Equations with Constant Leading Coefficients"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 41-52

TEXT OF ENGLISH ABSTRACT: In this paper we investigate the estimates of continuous dependence of the solution of the Cauchy problem for partial differential equations of an arbitrary type with constant leading coefficients. We first establish a basic estimate for the general partial differential operators with constant coefficients by means of L. Nirenberg's extensional inequality of L. Hormander's inequality for these operators, and then obtain the local estimates which are characteristic of Holder's continuous dependence of the solution on Cauchy data in several different measures for the problem under consideration. These estimates correspond to Hadamard's three circle theorem for analytic functions.

AUTHOR: SUN Shanli [1327 0810 0448]

ORG: Department of Mathematics

TITLE: "Unbounded Decomposable Operators"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 53-65

TEXT OF ENGLISH ABSTRACT: In this paper we introduce the concept of unbounded decomposable operators on Banach spaces, and extend some main properties of C. Foias' bounded decomposable operators to unbounded decomposable operators. Finally. we prove that unbounded spectral operators in N. Dunford's sense are also unbounded decomposable operators.

AUTHOR: AN Zhengzhi [1344 2973 2784]
LU Zhong [0712 1813]
LU Peiliang [7120 1014 0081]
XING Yinghua [6717 5391 5478]
et al.

ORG: AN of the Physics Department, Jilin University; LU Zhong, LU Peiliang and XING, et al., all of the Central Iron and Steel Research Institute, Ministry of Metallurgical Industry

TITLE: "An Investigation of Strengthening Effect of the TZM Alloys"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 66-70

TEXT OF ENGLISH ABSTRACT: In this paper we analyze the strengthening effect of TZM alloys by means of heat treatment, metallographic observations and X-ray phase analysis. It is pointed out that except for a small amount of dispersed carbides, the major parts of Ti and Zr in the alloys give an effect of solution strengthening. The forming of the shapes on the strengthening effect is not obvious. The other parts of the carbides are rich in the grain boundary.

AUTHOR: ZENG Qin [2582 3830]

ORG: Purple Mountain Observatory, Chinese Academy of Sciences

TITLE: "Theory of Exchange Interactions for Rare-earth Metal Gd"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese Nc 1, 1982 pp 71-84

TEXT OF ENGLISH ABSTRACT: Based on the biatomic model and Lowdin's strict definition, the exchange between two electrons on two Gd atoms and on their equal is calculated. Using these data and our approximate model of electronic structure for rare-earth metals, the microscopic Weiss factor of Gd is obtained. The agreement between the calculated and observed Weiss factor is good. The partially local and partially free property of $5d$ electrons is thereby verified.

AUTHOR: ZHAO Youchang [6392 0645 2490]
MENG Zhaofu [1322 2507 1381]

ORG: Both of the Department of Physics

TITLE: "Cavities and Fracture during the Superplastic Flow of Zn-Al Eutectoid Alloys"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 85-91

TEXT OF ENGLISH ABSTRACT: This paper investigates the effect of various strain rates and grain sizes on the fracture behavior during the superplastic flow of Zn-Al eutectoid alloys. We have observed the role of form, growth and linkage of cavities during superplastic flow and fracture. Experiments showed that cavities were first formed in the grain and phase boundaries, then these cavities were extended to soft β-phases. As the strain rate and grain size increased, the cavities grew rapidly and, through α-phases, produced interlinkage until fracture occurred. The hard α-phases could inhibit the growth and interlinkage of cavities under some conditions. We have also used the method of X-ray small angle scattering to study the role of cavitation in superplastic flow.

AUTHOR: KOU Xichun [1379 0823 2504]
LIN Dehou [2651 1795 0624]
WU Zhongwen [0702 1813 2429]

ORG: All of the Department of Chemistry

TITLE: "Studies on the Synthetic Polyarylsulfone Made by Bisphenol Desalting Method in Solution (IV)--Synthetic Polyarylsulfone 004 by New One-step Technology"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 97-102

TEXT OF ENGLISH ABSTRACT: Recapitulated in this paper is a new one-step technology for preparing polyanylsulfone 004 from bisphenol by means of a desalting method in solution. We have compared this new technology to the original one and discussed the properties of the product obtained by substitution of NaOH for KOH. Stabilities of the Na-salt product and K-salt product for decomposition were measured using the TG and DSC techniques. We found that Na-salt product was more stable than the K-salt product for thermal decomposition, so the one-step technique is more reasonable.

AUTHOR: ZHAO Muyu [6392 1970 1946]

ORG: Department of Chemistry

TITLE: "The Relation between the Neighboring Phase Regions and Their Boundaries (III)--The Application of the Theorem of Corresponding Relation in Phase Diagrams to the Phase Diagrams of Quaternary Systems"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 1, 1982 pp 103-111

TEXT OF ENGLISH ABSTRACT: The preceding papers have derived the theorem of corresponding relation between the total number of different phases in the neighboring phase regions (expressed by NPRs) and the dimension of their phase boundaries and its six corollaries in isobaric phase diagrams. This paper applies the above theorem and its corollaries to explain the relation between the NPRs and their boundaries in phese diagrams of quaternary systems. The relation between the NPRs and their boundaries in phase diagrams of quinary systems is also discussed briefly.

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CSO: 4009/271

AUTHOR: TAN Weiyan [6223 4850 3508]

ORG: Nanjing Hydrological Research Institute

TITLE: "MYBC--A Program Package for the Calculation of One-dimensional Unsteady Flow in Open Channels"

SOURCE: Beijing SHUILI XUEBAO [JOURNAL OF HYDRAULIC ENGINEERING] in Chinese No 1, 1982 pp 1-11

TEXT OF ENGLISH ABSTRACT: MYBC is a program package applicable to river networks with arbitrary geometric and hydraulic characteristics. It is based on the de Saint-Venant system of equations in complete form under nine combinations of upstream and downstream boundary conditions. It provides nine optional and typical methods which are classified into three categories (i.e., the explicit difference scheme, implicit difference scheme and characteristic scheme). The package can be mastered easily for convenient use, and also can be modified, extended and transferred to another computer in a short time due to its modular structure. Particular attention has been laid on its applications for the flow-concentration problem for dendritic river networks. In particular, a general description of dendritic open channel systems by the so-called tree-structured matrix has been proposed, so that MYBC is suitable for any natural watershed, except plex-structured river systems located in plains. Although all nine algorithms were introduced in the literature, improvement has been made in the formulas and their solution, including the correction of

[Continuation of SHUILI XUEBAO No 1, 1982 pp 1-11]

all errors discovered, so as to accelerate the process of machine calculation and extend the spectrum of applications. Numerical simulation for a series of examples has furnished preliminary experience of the performance of each method in stability, accuracy and computational efficiency, and a principle for the selection among various algorithms has been suggested.

AUTHOR: DING Baoying [0002 1405 3841]
WANG Guobing [3769 0948 4426]
XIE Liang'an [6200 5328 1344]
HUANG Shuping [7806 3219 5493]

ORG: All of the Water Conservancy and Hydroelectric Power Research Institute

TITLE: "The Optimum Design of Temperature Control for Mass Concrete Dams"

SOURCE: Beijing SHUILI XUEBAO [JOURNAL OF HYDRAULIC ENGINEERING] in Chinese No 1, 1982 pp 12-19

TEXT OF ENGLISH ABSTRACT: In this paper the optimum design of the temperature control for mass concrete dams has been researched by using the nonlinear program. The optimum design considers the minimum relative construction costs as the principle, taking x_1 (the compressive strength of concrete), x_2 (drop placing temperature by adding ice to mix water), x_3 (drop placing temperature by precooling aggregate of concrete), x_4 (drop temperature of concrete by initial cooling), x_5 (number of concrete blocks) and x_6 (the lift thickness of placing) as variables. For some variables which are integral and discontinuous, the problems were solved by mesh method and complex method. FORTRAN-IV computer programs have been made and examples of their application in engineering are given. The program may be widely used in design and construction.

AUTHOR: MAI Jiaxuan [7796 1367 3551]

ORG: Department of Hydraulic Engineering, Qinghua University

TITLE: "Computation of the Temperature Field and Temperature Load in Arch Dams. Part II"

SOURCE: Beijing SHUILI XUEBAO [JOURNAL OF HYDRAULIC ENGINEERING] in Chinese No 1, 1982 pp 20-32

TEXT OF ENGLISH ABSTRACT: This subject is divided into two parts. In the first part, which was published in the JOURNAL OF HYDRAULIC ENGINEERING, No 6, 1981, some new formulas for computation of the temperature field in arch dams were given. Based on these formulas, computations of the temperature load in arch dams are discussed in the second part. Several examples are given for discussion of some problems and these examples are compared with practical measured values.

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[Article by Hu Ping [5170 1627] and Deng Nan [6772 2809]: "In the Face of the New Situation--Looking Back on the Implementation in the Past Year of the New Policy for Scientific and Technological Development and Looking Forward to Its Prospects"; passages within slantlines denote boldface as published]

[Text] At present, an upsurge of relying on science and technology to promote economic and social development is in the making throughout the country. The strategic thinking of "economic and social development must rely on science and technology, and science and technology must serve economic and social development" is beginning to take root in the hearts of the people. Science and technology as an effective means of policymaking and as a powerful function of productive forces have become increasingly apparent in both the macro and micro aspects.

Since the founding of the People's Republic, several upsurges have appeared in the development of our scientific and technological undertakings. In 1956, following the development of large-scale economic construction, the first upsurge of the "march toward science" appeared in our country, and important results were achieved. Unfortunately, it was very quickly interrupted by the political movement which followed. The national scientific and technological work conference convened in Guangzhou in 1962 cleared up the "leftist" mistakes of the latter part of the 1950's and adopted a series of measures to consolidate and strengthen scientific and technological work. There was a new development in scientific and technological undertakings. However, the "great cultural revolution" which began in 1966 again caused a new and greater setback to scientific and technological undertakings. The national science congress held in 1978 was a great turning point in the development of scientific and technological undertakings in China. This congress thoroughly criticized politically the long-standing "leftist" abuses which seriously fettered the development of scientific and technological undertakings for many years, implemented the party's policy for intellectuals as well as other policies and expounded that science and

technology is the Marxist principle of productive forces. This had a far-reaching impact on the development of scientific and technological undertakings in China. However, the inadequacy was, this congress did not directly link up the development of science and technology with economic and social development and did not put forward the effective method and measure of relying on science and technology to promote economic and social development.

The new policy for scientific and technological development put forward by the CCP Central Committee in 1981 hallmarked a new stage in the development of scientific and technological undertakings in China. The central idea of this new policy is to strengthen close integration and coordinated development between science and technology and the economy and society. Under the impetus given by this new policy for scientific and technological development, new changes have appeared on the scientific and technological front in the past year.

/1. Many party and government leaders from the Central Committee to the localities have paid attention to further strengthening scientific and technological work./ This kind of attention is no longer just verbal. They are beginning to regard the development of scientific and technological work as an important component in the development of strategy. Many districts and departments throughout the country have already integrated science and technology with the economy, and proceeding from the economic characteristics and industrial superiority of their own district and department, formulated an overall plan for the coordinated development of science and technology and economy. They have determined the orientation and problem of scientific research according to the needs of economic development, and at the same time, also relied on science and technology to tap latent productive capacity and to carry out a technical restructuring of the national economy. They have obtained definite results in getting resources, energy, quality, output and economic returns from science and technology. Facts have shown that the development of science and technology is no longer a not very essential "soft" task, but it is a "tough" task capable of affecting the overall situation.

/2. The broad masses of scientific research units as well as scientists and technicians have heightened their consciousness of serving economic and social development and further defined the basic goal and orientation of developing science and technology./ While steadily strengthening basic research, China at present has concentrated its main force on applied research and developmental research. Many units have readjusted the problems and items of scientific research, strengthened direct ties with production departments, accepted research tasks and assignments from production departments, supplied technical advice and service to the whole society and gradually developed the orientation of scientific research to meet the needs of society. This has not only effectively promoted the development of production, but has also stimulated the work of the units themselves.

/3. The role of scientists and technicians in modernization is being further respected./ They are not only bringing their specialities into play in such concrete work as scientific research, planning and production, but they are also playing an important role in the strategic policymaking of the whole district, the whole department and even the whole country. Some policymaking organs are beginning to pay attention to hearing the views of scientists and specialists and carrying out a feasibility study before they adopt an important measure. Some scientists and specialists with organizational and administrative ability have joined leading bodies at various levels.

/4. There has been new progress in the popularization and application of scientific and technological achievements./ As a result of implementing the principle of "four shiftings" (shifting scientific and technological achievements from the laboratory to production, shifting from advanced areas in the country to backward areas, shifting from military use to civilian use and shifting from outside the country to inside the country), the scientific and technological achievements of many places no longer remain at the "sample, souvenir and exhibit" stage but can be more quickly applied in production. Many new forms of technical transformations, such as various forms of contract systems, compensative technological transfers, scientific research and production joint ventures, technical advice and services, and technical achievements fairs have been created in practice.

/5. Great developments have taken place in the work of enterprise-run scientific research./ After expanding the decisionmaking power of enterprises and setting up the economic responsibility system, many enterprises changed their long-standing tendency of neglecting the technical structure of the past and showed a greater interest in product and technical quality. According to the investigation of some provinces and municipalities, among the important technological achievements scored in 1981, about one-third to one-half were supplied by enterprise-run scientific research projects. State-run scientific research has distinctive characteristics and superiority and can quickly provide economic returns. Some of the enterprises, which were always operating at a loss, have quickly turned losses into profits and changed their features because of a breakthrough in technology.

/6. A new upsurge in studying and applying science has appeared in the vast countryside./ The agricultural production responsibility system has greatly aroused the demand of the broad masses of peasants for "scientific farming." Apart from the existing agricultural techniques stations in the countryside, there are now such new things as "agricultural science households," and they are playing a hardcore as well as exemplary role in scientific farming. In the past years, various measures have been adopted in many districts throughout the country to extensively popularize the achievements of scientific research in agriculture and notable economic results have been achieved. There is a marked improvement in the position of agricultural scientific and technical cadres and they are generally welcomed by the peasants.

/7. The channels of scientific research funds are beginning to develop toward diversification./ In the past, scientific research funds came under the unified allocation of state financial departments and the amount of funds had no direct connection with the economic returns of scientific research achievements. At present, the economic returns of scientific research achievements receive widespread attention from society. Scientific and technological investment has now become a "ten thousandfold profit" matter. The channels of investment have become increasingly diversified. Apart from unified state financial allocations, many localities, departments and enterprises have in varying degrees all squeezed out funds for scientific and technological investment. Moreover, the additional income obtained by the scientific research units from the transfer of technology, supply of technical services and sales of scientific research achievements and trial-manufacture products has also become an important source of funds for the scientific research units.

/8. There is a new way for the rational circulation of qualified scientific and technical personnel./ As regards the employment of scientific and technical personnel, apart from unified assignment by personnel departments, some localities have been experimenting with "rational circulation" within a given framework. Some have "invited applications" for technical guidance from scientific research units and institutions of higher learning. Some have formed "joint ventures" with provincial, municipal and enterprise research units and used outside scientific and technical forces to serve the production of their own province and municipality.

/9. Large numbers of newly emerging medium-size and small towns, which relied on science and technology to quickly change their features, have appeared throughout the country./ The 60 percent increase in profits and the 40 percent increase in output of some urban industries have been obtained from technical progress. These towns have one distinguishing feature in common, and that is, they have really given prominence to scientific and technological work in the modernization and have given an impetus to the whole economy and to the rapid development of industrial production in particular.

/10. There have been great developments in the study of scientific and technical policies./ Last year, China held two national conferences for the study of scientific and technical policies. At present, almost all provinces and municipalities throughout the country have set up organs for the study of scientific and technical policies. Quite a few districts and departments have set up research organs for the study of science. These organs and organizations have, on the basis of conducting a vast amount of investigation and study, put forward many important views and suggestions on implementing the new scientific and technical policies, restructuring our scientific and technical management system, studying our strategy for social and economic development and forecasting the trends of scientific and technical as well as economic development both at home and abroad.

Naturally, we should see that the implementation of the new policy for our scientific and technological development is only just beginning. There are still many problems and difficulties. After the implementation of the new scientific and technical policies, there will be corresponding changes in our scientific and technical management system, scientific research and planning system, scientific research funds management method and scientific and technical personnel management method.

In the face of this new situation, our comrades on the scientific and technical front hold that we must first grasp the following links:

Change the Outmoded Work Method of Responsible Scientific and Technical Departments

In implementing the new policy for scientific and technological development, there should be a big change in the leadership style and work method of the scientific and technical departments at various levels. They must break away from the former habit of limiting themselves to a narrow circle of departments and from the same old ways of administrative management and document reports. They must closely cooperate with other departments and grasp important problems relating to economic and social development together. Everything from determining economic targets, reforming the economic structure and deploying productive forces in a rational manner to surveying and utilizing resources in a rational manner, restructuring the technology of enterprises and drawing up technical and economic policies should be grasped. They must enliven their thinking, enliven scientific research organs and enliven activities for finding ways of making money for scientific research. They must grasp policies, coordination, industrial superiority, uniting scientific research and production and popularizing scientific research achievements. By means of investigation and study and the carrying out of guidance according to category, they must unify various tasks on the path of closely integrating science and technology with coordinated economic and social development.

Continue To Grasp Properly the Work of 'Four Shiftings'

The carrying out of the "four shiftings" is the scientific summing up of both the positive as well as negative aspects of the experiences of our scientific and technological work in the last 30 and more years. The present question is how to quickly, effectively and persistently carry out this kind of change. This involves restructuring the economic system of the state and also involves the economic policy, tax policy, price policy, credit policy, technological secrets policy and patent right system of the state. At present, many forms of shifting have been created in various parts of the country. However, most of them are still at the primary stage. We must continue to improve them, theoretically explain them, systematically perfect them and set up laws to protect them.

Organize Forces To Make a Concentrated Attack on Science and Technology

At present, in the solving of some important scientific research problems; there are still such defects as duplication, dispersed manpower and lack of unified planning and coordination in many departments and districts. Experiences from both at home and abroad have indicated that in order to solve important scientific and technical problems, we must organize the forces of various sectors, rationally carry out distribution of labor and cooperate in making a concentrated attack before we can get double the result with half the effort. For the sake of organizing properly a concentrated attack, we must first select a number of projects, make proper arrangements for funds, materials and manpower, define responsibilities and strictly carry out periodic inspections. Not only key projects of a national nature must carry out work in this way, but some of the projects of a departmental or regional nature must also carry out work in this way. In the concentrated attack, responsible scientific and technical departments must closely cooperate with the departments and units concerned and actively bring their organizing and coordinating role into play.

Actively and Reliably Carry Out the Restructuring of the Scientific and Technical Management System

Following the implementation of the new policy for scientific and technological development, certain contradictions in the scientific and technical management system have become more clearly exposed. The restructuring of the scientific and technical management system has become imperative. This kind of restructuring deals with a wide range of sectors including perfecting scientific research planning, expanding the decisionmaking power of scientific research units, implementing compensative technological transfer, perfecting the scientific research contract system, diversifying the channels of scientific research funds and using qualified scientific and technical personnel in a rational manner. Even though our country is still in the period of readjusting at present and all-round restructuring cannot be carried out, we should actively create conditions by beginning to restructure the parts which are already matured, accumulate experiences and gradually popularize them. We cannot passively wait. If a unified method for the whole country cannot be formulated to solve some of the problems for the time being, we could formulate some provisionsal rules and regulation based on the actual situation of our own district or department to expedite the development of work.

Strengthen the Study of Scientific and Technical Policies

The study of scientific and technical policies is a kind of comprehensive research spanning departments and disciplines and involving the fields of politics, economics, society, science and technology and education.

Experiences in many countries have indicated that the study of scientific and technical policies has a very important bearing on the development of scientific and technological undertaking and on the coordinated development of science and technology, society and economy. Apart from the several problems mentioned beforehand, there are many problems we must study at present. A district or a department in particular must firmly grasp industrial superiority, key projects and their economic returns, explore correct ways of applying science and technology to promote development, really act as "brain trust" and "staff officer" to leading members at various levels and make contributions to scientific policymaking.

CSO: 4008/144

APPLIED SCIENCES

INFORMATION RESEARCH INSTITUTES PROVIDE NEEDED ASSISTANCE

Aid in Energy Conservation

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Xiangfan City Scientific Information Research Institute Combines Efforts With Economic Buildup To Launch Information Work"]

[Text] The Xiangfan City Scientific and Technical Information Research Institute in Hubei Province is a new institute established in 1975. For several years, it has closely combined its efforts with the needs of development in production, carried out research and investigation in a big way, quickly launched information gathering work and achieved notable economic results.

In investigating and researching information, the institute discovered that conservation of energy and conservation of raw materials are the most common problems in the city's industrial production. Therefore, it concentrated on finding and introducing advanced technology in these aspects and developed an information service. For example, before 1977, many factories throughout the city had a power utilization rate of between 0.6 and 0.7, and some even had a lower rate. These factories were fined because their power utilization rate was lower than the national standard of 0.8. After the information institute learned of this situation, it quickly searched for information on "power factor compensation devices" and tested the devices at the city's lumber company. The power utilization rate rapidly increased from 0.6 to 0.95, and the company changed from being fined to being rewarded. After the successful completion of the tests, a report was immediately presented to the city leadership and it was suggested that such devices be popularized throughout the city. For over 4 years, the whole city's power factor has been improved, thus reducing the fine by 746,000 yuan.

Information regarding product competition is urgently needed in order to provide information and technology to develop new products that suit the market needs. For several years, the Xiangfan City Information Institute conducted investigations and studied special topics to develop new products and made relatively large contributions. For example, in 1978 the institute reviewed domestic and foreign literature and discovered that porcelain

fiber is a new type of refractory material that has a bright future for development, and Xiangfan City also has the raw materials for producing this product--pyromorphous gems. Thus, members of the institute went to other places to learn the technology and techniques to produce porcelain fibers, and after investigating the market for the product, they presented a report entitled "The Possibility of Developing and Producing Porcelain Fiber Products in Our City" to the city science committee. The report analyzed the source of raw materials, production technology and conditions, cost, profit, investment estimates, and market needs. The city science committee approved their opinions and included this subject in the scientific research projects for 1979. The trial production was successful, and this blank in the south-central region was filled. The city committee decided to establish a second refractories plant to produce this product. This new energy-conserving material has been popularized throughout the province.

Knowledge of Document Searching

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Nantong City Scientific and Technical Information Research Institute Strengthens Counselling Service, Improves Rate of Utilization of Information"]

[Text] The method of the Nantong City Scientific and Technical Information Research Institute of Jiangsu Province has provided three types of experience in how to develop the function of scientific and technical information.

First, it actively developed information search and retrieval for others along with counselling services. During the past 2 years, the institute has surveyed the basic situation of more than 300 factories in the city. Besides regularly providing general information and data to the factories, it has also developed services aimed at specific subjects. For example, the quality of the products produced by the city's daily commodities chemical plant was affected because of a poor antiseptic used in the production of Pearl face cream. For this purpose the scientific and technical information institute wrote letters to plants in other localities seeking information, looked into the institute's own information, found the prescription and information, and provided the information to that plant as reference for producing new products.

Second, it strengthened the transmission of secondary information. To enable the basic level units to be aware in time of the information and data gathered by the institute, it scanned the information received during the day and organized the information each day and every month. During the month, it compiled a "table of contents of newly received data." Within a week, seven or eight units came forward to seek related information based on the table of contents.

Third, it popularized knowledge about document searching. During the survey of basic level units, the Nantong City Scientific and Technical Information Institute discovered that less than 0.3 percent of the people among the whole city's scientific and technical personnel had any knowledge about searching for foreign and domestic documents. Therefore, it conducted several classes in document search techniques so that concerned scientific and technical personnel were able to grasp the basic method of searching for information.

Sunflower, Coal Mud Problems

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Fuxin City Scientific and Technical Information Research Institute Serves as a Good Adviser for the Leadership"]

[Text] Fuxin city in Liaoning Province is our nation's major base for producing sunflowers. The sunflower planting area constitutes one-fourth the national total. The leading comrades of the city instructed the Fuxin Scientific and Technical Information Institute to contribute to the development of sunflower production. Afterward, the institute organized personnel to look for related information, held a discussion meeting on sunflower production techniques, and systematically introduced seven technical measures in sunflower production in the institute's FUXIN SCIENCE AND TECHNOLOGY NEWS. At the same time, it also sent information gatherers to Jilin province to investigate sunflower insect pests and made proposals to prevent and control the orobanche indica (?) disease, which causes serious damage. After approval by the leading comrades of the city committee, the prevention and control techniques were quickly popularized throughout the city. The institute also organized the city's network of spare-time foreign language translaters to translate related information totaling over 300,000 words and published two books entitled " Translations on the Sunflower." The books were distributed to the agricultural cadres and technical personnel of the city, county and commune. In 1980, Fuxin area realized a bumper sunflower harvest. The yield reached 120 million jin.

Fuxin is also one of our nation's coal-producing bases. A large amount of coal mud remaining after coal selection has caused serious pollution of the urban environment. The city committee decided to solve and treat the problem of coal mud. Based on the situation, the Juxin City Scientific and Technical Information Research Institute organized concerned personnel to make an inspection tour of Hebei, Shanxi and Shaanxi Provinces, read through a massive amount of data, and presented a preliminary investigative report on the recovery and utilization of coal mud at home and abroad. At the same time, it proposed suggestions on how to develop the utilization of coal mud in the city. The city level information network of the northeastern region wanted to solve the problem of comprehensive utilization of coal mud in the northeastern cities and commissioned that institute to conduct a survey for comprehensive utilization of coal mud in the six cities of Fuxin, Hegang, Shuangyashan, Jixi, Fushun, and Benxi. After completing

the task, it also held a discussion meeting of the experts of the six regions and took notes on the discussion meeting. The information and data drew the attention of the city's leadership.

Foreign-Language Translation Network

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Zigong City Scientific and Technical Information Research Institute Organizes a Spare-Time Foreign-Language Translation Network"]

[Text] The Zigong City Scientific Research Department in Sichuan as well as large enterprises and many units lacked translation capabilities. To solve the difficulty in translation, in 1978 the Zigong City Scientific and Technical Information Research Institute organized a citywide spare-time foreign-language translation service network. Now, there is a team of 25 people who can translate five languages--English, French, German, Russian, and Japanese--and the service has established "general regulations of the foreign-language service network" and related systems. For more than 2 years, the team conducted four Japanese and English learning classes for scientific and technical personnel and held more than 20 operations lectures and exchange of experience meetings. The team translated and edited over 600,000 words of information for the city's scientific research, production and foreign trade units, and printed over 400 pages of English text.

In service work, this translation network has been able to do all the work requested and has finished the tasks quickly. The translations are reliable, the fees are inexpensive, and the work has been welcomed by the users. For example, in 1979 the city's chemical engineering research institute test-produced a laser tube material and urgently needed foreign-language information for reference. This institute did not have sufficient translation capabilities and it could not find outside help. The spare-time translation network learned of the situation and actively helped out by translating over 60,000 words of information in time. Last April, Zigong's Longjing Switch Factory was invited by the provincial business department to participate in the Hangzhou electromechanical products exhibition. Prior to the exhibition, a products explanation brochure in English and Chinese had to be sent to the exhibition. The spare-time translation network rushed translations of brochures on five products for the plant, thus enabling it to participate in the exhibition on time and to conclude more than $300,000 worth of export trade.

9296
CSO: 4008/96

CHINESE CHARACTER INFORMATION MANAGEMENT SYSTEM DEVELOPED

Fuzhou FUJIAN RIBAO in Chinese 3 Nov 81 p 1

[Article by reporter Tang Wenyuan [0781 2429 0337]: "Welcome News About Using the Microcomputer To Process Chinese Character Information; Multiple User Chinese Character Information Processing System Is Successfully Developed"]

[Text] The Fujian Provincial Electronics Technology Research Institute and Beijing University have jointly developed a multi-user Chinese character information processing system successfully. It was exhibited at the National Computer Exhibition in Beijing and received high praise from concerned departments of the central authority. The successful development of this system will enable the widely used microcomputer systems in our nation to operate with information in Chinese characters. It is another new achievement in our nation's electronic technology. A prototype of the system was shipped back to Fuzhou on 27 October to prepare for small-batch trial production.

The multi-user Chinese character information processing system is a microcomputer system that processes information in Chinese characters. It consists of a DJS040 microcomputer, three Chinese character display terminals, one Chinese character printer, and four flexible disc drives. It can store 8,000 Chinese characters. The form of the characters is beautiful and clear. The system can be used for text compilation and page composition in journalism, publishing and printing, business management, production control, statistical reporting in industry and mining, operations processing for postal and telecommunications, filing and searching information, data and documents, military command, job processing in government agencies and offices, and it can also serve as a terminal for other large computers.

This Chinese character information processing system is small in size, its function is complete and its operation is convenient. Working at the Chinese character display terminal requires only the use of a detector pen. The pen is maneuvered on a touch-sensitive keyboard to delete or insert text at will. Corrections moving lines of text, combining sentences and such editing and composing functions are displayed on the fluorescent screen immediately. After composing the text, it can be stored in the mainframe memory and can be accessed by command any time. If the text is to be printed, the operator only has to press the key to operate the printer. This Chinese character information processing system is being further perfected.

9296
CSO: 4008/96

FEATURES, APPLICATIONS OF PLASMA ENGINE DESCRIBED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3, Mar 82 pp 12-13

[Article by Song Yuyang [1345 5940 7122]]

[Text] Ever since the successful launch of the first artificial earth satellite in October 1957, a variety of satellites and spacecraft have been placed into the sky one after another. Along with the advancement in space technology, a number of new propulsion devices have appeared. The plasma engine is one of these devices.

What the Plasma Engine Is

Before we describe what a plasma engine is, let us first discuss the nature of plasma.

Plasma is an ionized gas. When gas molecules are bombarded by electrons, they become ionized. If the electrons are lost, the molecules become positive ions. For example,

$$H_2 + e = H_2^+ + 2e$$
$$H_2 + e = H_1^+ + H_1 + 2e$$

Therefore, a plasma is a mixture of ions, electrons, and neutral particles; on a macroscopic level they are electrically neutral.

In a plasma engine used in space travel, the plasma is generally produced by gases or vaporized di-electric materials.

In order to ionize a working medium to produce plasma, the medium must be heated to a temperature where the kinetic energy of the atomic thermal motion becomes greater than the ionization energy. For hydrogen or deuterium, the required temperature is 160,000°K. Most existing materials cannot tolerate such high temperatures. But in a plasma, the actual temperature is much lower because the electrons and ions are in a state of equilibrium. To ensure reliable engine operation, a magnetic field is used to constrain the plasma (as shown in Fig. 1) so that the high-temperature plasma will not come in contact with the chamber wall.

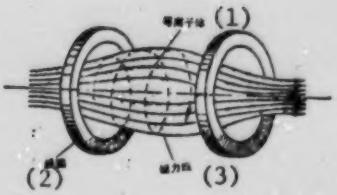


Fig. 1. Constraining Plasma Using Magnetic Field

Key:
(1) plasma
(2) coils
(3) magnetic lines

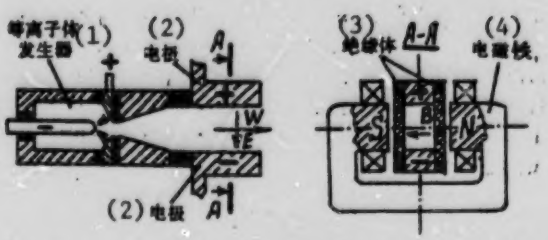


Fig. 2. Diagram Illustrating the Operation of a Plasma Engine

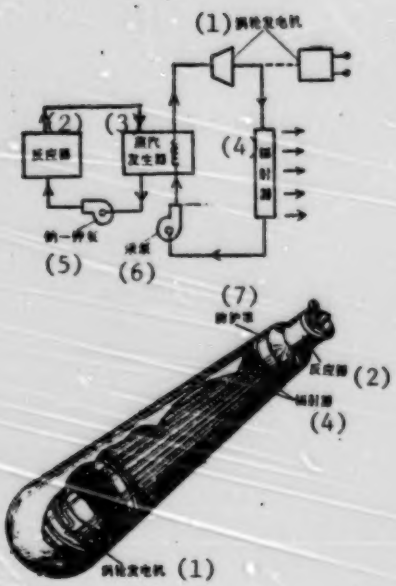
Key:
(1) plasma generator
(2) electrodes
(3) insulator
(4) electromagnet

Fig. 2 is a diagram illustrating the operation of a plasma engine. It has two electrodes--annode and cathode; the space between the electrodes and the side walls provides a passageway for the plasma. This passageway is perpendicular to the electric field E on the one hand, and penetrates the magnetic current generated by the magnetic inductance B on the other. From the plasma generator the plasma enters the accelerator. Inside the accelerator current flows from the annode through the plasma to the cathode. Under the action of both the electric and magnetic fields the propelled speed plasma jet leaving the accelerator produces a thrust in the opposite direction. Since in this engine the conversion of electric energy to kinetic energy is accomplished by a plasma medium, it is called a plasma engine.

Power Unit

A plasma propulsion system has two major components: the thrust-producing plasma engine, and the power unit, which provides electric energy to the engine as well as other segments of the satellite or spacecraft. Currently, power units with 5 to 50 kw output have been built for space travel. There are two types of power units for plasma engine: one is nuclear power unit; the other is solar power unit.

Fig. 3 shows the SNAP-2 power unit. The top part of Fig. 3 is a simple operational diagram; the bottom part shows the exterior of the power unit. This is a dual-circuit system in which the first circuit uses sodium-potassium alloy (which has a melting point of -11°C, and a boiling point of 784°C under a pressure of 10 P_a) as the heat transfer medium, and the second circuit uses mercury as the working medium. The sodium-potassium alloy emerges from the reactor at a temperature of 650°C, and enters the vapor generator where mercury is heated to a temperature above its boiling point of 357°C. The vaporized mercury (at a pressure of 700 KP_a and temperature of 620°C) drives the turbine which rotates at a speed of 40,000 rpm, and produces 3,000 watts of power. The mercury vapor exhaust from the turbine enters the radiator where it is cooled and condensed into liquid (at a pressure of 42 KP_a and a temperature of 315°C), and then is returned to the vapor generator through the mercury pump. The entire power unit without the shield weighs 345 kg.

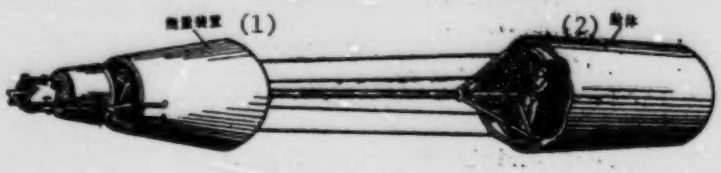


Key:
(1) turbo-generator
(2) Reactor
(3) vapor generator
(4) radiator
(5) sodium-potassium pump
(6) mercury pump
(7) protective shield

Fig. 3. The SNAP-2 Power Unit and Its Operational Diagram

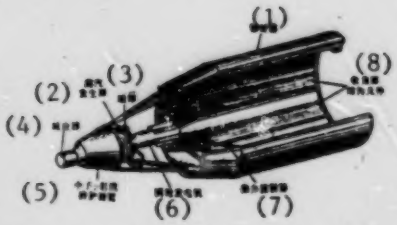
Because nuclear fuel has a problem with critical mass, small plasma engines usually use solar power units.

On a manned spacecraft, maintaining a certain distance between the nuclear power unit and the astronaut cabin to ensure safety is required. Fig. 4 shows the typical location of a power unit in a spacecraft. This is a 25-kw power unit which weighs 3,600 kg without the shield; the shield weighs 2,000 kg, and the distance between the power unit and the astronaut cabin is 15 m. Fig. 5 shows another type of power unit.



Key: (1) power unit
(2) cabin section

Fig. 4. Typical Location of SNAP-2 Power Unit in a Spacecraft



Key: (1) radiator
(2) vapor generator
(3) magnetic rod
(4) reactor
(5) protective shield against neutrons and γ-rays
(6) turbo-generator
(7) thrust control device
(8) collector elements

Fig. 5. Structural Diagram of a Power Unit

Special Features and Applications

The plasma engine has the following special features:

1. large specific impulse (10^2 - 10^4 seconds)
2. low thrust (10^{-3} - 10 newtons)
3. long operating life
4. capable of multiple engine starts
5. low efficiency
6. thrust to weight ratio less than 1

The last feature implies that a plasma engine must rely on other propulsion devices (such as solid or liquid rocket engines) to inject a spacecraft into orbit before starting to operate. Since this type of engine generates relatively low thrust, it is primarily used for position keeping, attitude control, and orbit correction for satellites, spacecraft, and space stations.

As a low-thrust, long duration propulsion device, the plasma engine has some outstanding characteristics. For example, a chemical-fuel rocket engine with a thrust of 0.01 kg and an operating life of 1 year requires 1,240 kg of high energy fuel with a specific impulse of 250 seconds; therefore, the total engine weight including engine housing and accessories will reach several tons. Under the same conditions, a plasma engine would be much lighter and more reliable.

On the basis of engine operation, plasma engines can be classified into two types: the continuous operation engine and pulsed operation engine. The former does not require a condenser and is simpler in structure. The Soviet satellite "Meteor" launched in 1971 had two continuous operation plasma engines each with a thrust of 0.02 newtons. In February 1972, with the aid of these engines, the satellite was transferred into a synchronous orbit.

At present, the abrasion type pulsed plasma engine is the most commonly used in space travel. This type of engine uses volatile di-electric materials such as poly-tetrachlorine ethylene as the working medium. When the condenser discharges, this material is vaporized under heat and ionized at the same time. Under the action of electric and magnetic fields, the ionized gas exits from the engine at high velocity, thereby generating thrust.

In December 1964, the Soviet Union launched the Zond-w monitoring station (5.37 million km from earth) toward Mars, which for the first time used six abrasion type pulsed plasma engines for direction control. The engines were operated by command signals to maintain the station's position relative to the Sun in a given time period.

In 1968, the United States launched the "Lincoln Experimental Satellite No 6," which had four abrasion type pulsed plasma engines built by "Fairchild" Corporation to maintain the longitudinal position of the satellite. Each engine operates on a 6-sec pulse cycle; when all four engines operate in series, the net pulse interval is 1.5 seconds. It is estimated that each engine can discharge 12×10^6 times; each discharge produces a thrust of

2 mg; and the operating life in space is over 2 years. Recently, this country successfully flight tested two pulsed type plasma engines. This marked a new phase of China's research and development efforts in electric rocket engines, and placed China as the fourth nation in the world to flight test electric rocket engines in space.

3012
CSO: 4008/124

SUCCESSFUL FLIGHT TEST OF Y-10 IS GREAT SOURCE OF PRIDE

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3, Mar 82 pp 2-3

[Article by Xie Chu [6200 4342]]

[Text] The exterior of this airplane is just beautiful. On the 43-m silver-white fuselage are painted three blue and red stripes; four large turbofan engines are suspended underneath the 42-m wing span; the vertical tail is 13m in height, and has a five-star red flag painted on it, which looks particularly impressive under the sunlight. This is the first large jet passenger plane designed and built by this country--the "Y-10."

The airplane was parked at one of Beijing's airports. Members of the flight test group led us up the boarding ladder and into the rear passenger cabin. The number of seats in the cabin can be varied according to specific needs. For long-range international flights, the cabin can be divided into first-class and tourist sections with a total of 124 seats; for domestic flights, it can have a single section with 149 seats; for short-range economic flights, as many as 178 seats can be accommodated. As we passed through the rear cabin toward the front of the airplane, we noticed the comfortable seats each equipped with air-conditioning vents, reading lights, luggage compartments, and life jackets. According to the comrade engineers, the Y-10 is designed on the basis of domestic civil aviation requirements, but it also meets the requirements of international civil aviation organizations.

Inside the cockpit at the front of the airplane, there are five seats: the two front seats are for the captain (pilot) and the co-pilot, the middle seat is for the engineer, and the two rear seats are for the navigator and the radio operator. The front and side walls and the ceiling are covered with flight instruments. When I was invited to sit in the pilot's seat and allowed to experience the feeling of operating such a complex airplane through the wide view window, I could not help remembering 7 years ago when I was touring the plant at Shanghai where the Y-10 was being developed. At that time, the design and research work of the Y-10 had just begun, and I was in the cockpit of a wooden mock-up. The mock-up was the same size as the real airplane, and was primarily used by the designers to arrange various components inside the airplane. It is amazing that in just a few years the blueprint and mock-up has become a reality. One can imagine how much sweat and labor had been contributed by the aeronautical engineers, the party officials, and the technicians.

In a conversation with the flight test group leader, I could sense the pride he had in flight testing the first Chinese-designed large passenger airplane. He was more than happy to answer all my questions.

"During the flight from Shanghai on 8 December, what was your flight speed? What was the total flight time?" I asked.

"850 km per hour, on Mach 0.79 (i.e., 0.79 times the speed of sound). The total flight time was 1 hour 48 minutes. However, since advanced wing design is used on this airplane, the maximum cruising speed can reach 900 km per hour," he replied.

"Were there any passengers? What was the take-off weight?"

"There were several tens of passengers, the take-off weight was 87 tons--not fully loaded. The airplane was designed to have a take-off weight of over 100 tons."

"How did it feel during the flight?"

"Very smooth. From Shanghai to Beijing, we cruised at an altitude of 9,000 m. The ambient temperature was more than 30°C below zero, but the temperature inside the cabin was maintained at 18°C. On our return trip we will fly at an altitude of 10,000 meters."

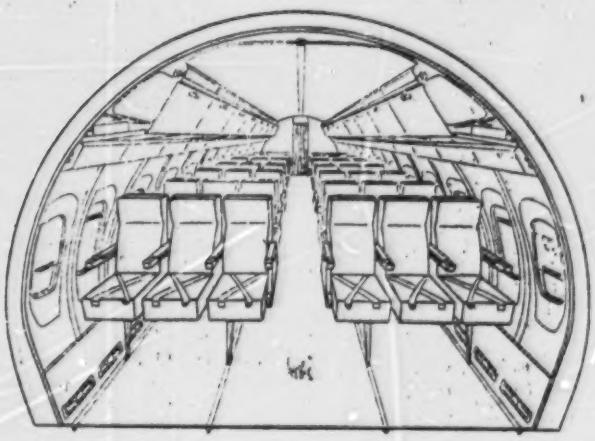
"Have you ever flown other airplanes before? Do you have any comments to make?"

"I was transferred to the Y-10 flight program 2 years ago. Prior to that I had several thousand hours of flying time, primarily on Boeing airplanes. I am really pleased to be able to fly our own airplanes."

The Y-10 airplane was first flown in Shanghai on 26 September 1980. During the past year many flight tests were performed. The airplane used in the flight tests was the No 2 prototype; the No 1 prototype had been used in static destruction tests. Up to the present, the overall flight test plan has not been completed. This round trip flight between Shanghai and Beijing was an important part of the plan. But in order to perfect the design of an airplane, particularly the design of a large passenger jet such as the Y-10, a large amount of additional work is required.

In this country there has been very little experience in designing passenger airplanes. Therefore, the development and flight test of the Y-10 will provide valuable experience in the future. After the maiden flight of Y-10 2 years ago, it received a number of reviews from foreign journals. The British weekly FLIGHT INTERNATIONAL reported: "China's main objective in developing the Y-10 is not only to produce a few passenger airplanes, but also to develop its technology in aeronautics." REUTERS commented: "According to aviation experts, developing a large passenger plane such as the Y-10 will provide valuable experience for the Chinese aeronautical engineers and scientists. Once they master such advanced technologies. China will no longer be referred to as a developing country by others."

The car started moving away. Looking back at the Y-10 parked on the open field, we all shared the common thought: the intelligence and capability of Chinese scientists and engineers are certainly not inferior to that of their foreign counterparts. We hoped that in the future there will be more and better Chinese airplanes carrying cargo and passengers across the sky of China!



Note: The inside dimensions of the passenger cabin are as follows: 30.4 m long, 3.48 m wide, 2.2 m high, and approximately 200 cubic meters in volume. Each row can accommodate six seats, with a walk-way in the middle. The air-conditioning system provides a residual pressure of 0.6 atmosphere, and a controllable temperature range between 16°C and 30°C.

Fig. 1 Cross Section of the Passenger Cabin of the Y-10

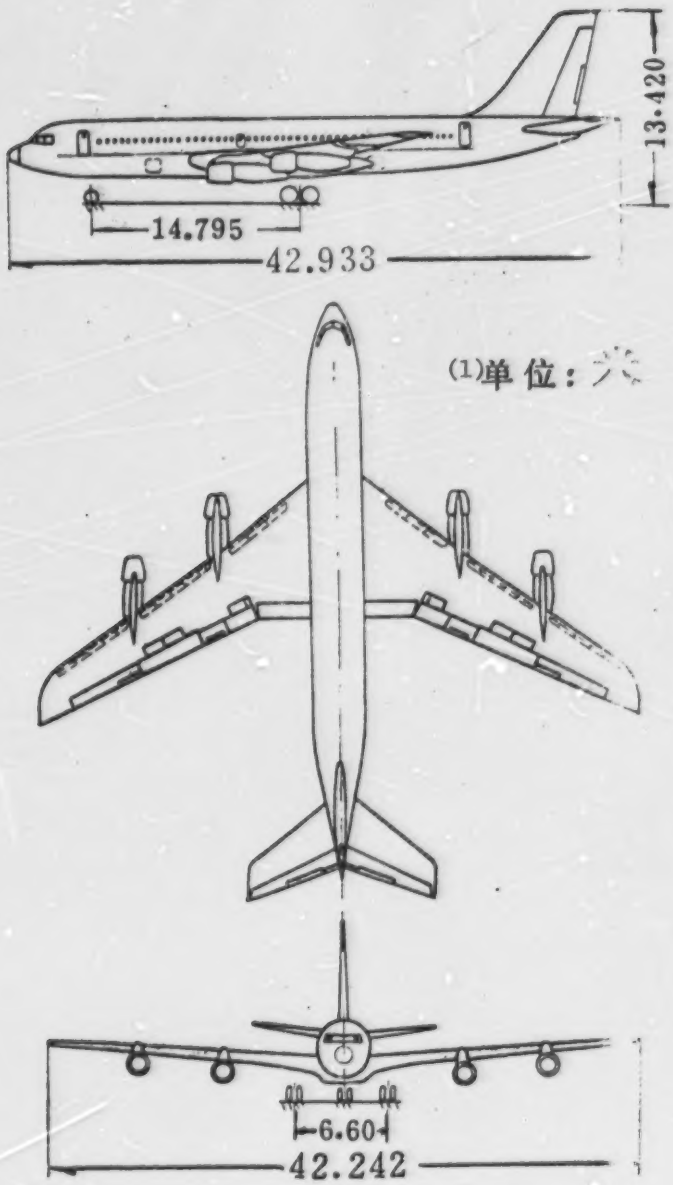


Figure 2. The three Views and Exterior Dimensions of the Y-10 Passenger Airplane

Key: (1) 1 unit: meter

3012
CSO: 4008/124

BRIEFS

COLD LIGHT SOURCE BLUEPRINT DEVELOPER--The nation's first large heavy nitrogen, ammonia-free cold light source blueprint developer has been successfully developed. Up to now, the blueprint developers manufactured domestically have generally used high-voltage mercury lamps as the light source for exposure. They waste electricity, the temperature of the working environment rises, and the blueprint paper is sometimes blurred by high temperature. This affects the use and storage of blueprints. Workers have to operate under high temperatures and the work conditions are very harsh. For this reason, the Beijing Geological Instruments Plant, the Beijing Light Bulb Plant, the Beijing Blueprint Developing Plant and the Beijing Nonferrous Metals Research Institute with the support of the Beijing City Technology Exchange Station finally developed a new copying technique using a heavy nitrogen, ammonia-free cold light source successfully. This new blueprint developer produced by the Beijing Geological Instruments Plant conserves 90 percent of the electricity compared to the hot light source blueprint developer. It also eliminates environmental pollution and improves the working conditions. The cost of the whole machine is reduced by 20 percent. This achievement has filled a blank in our nation. [Text] [Beijing BEIJING RIBAO in Chinese 14 Jan 82 p 2] 9296

CSO: 4008/96

GUANGZHOU TO BUILD CHINA'S FIRST EYE BANK

Shanghai WEN HUI BAO in Chinese 16 Mar 82 p 1

[Text] The preparations for the first eye bank in China at the Opthalmological Hospital of Zhongshan college of medicine in Guangzhou are complete, creating conditions for the blind to undergo sight-restoring surgery. In order to support the construction of the eye bank, at the January session of the national conference on the prevention and cure of blindness, more than 100 eye specialists signed a proposal to donate their eyes after death. Afterwards, more than 40 doctors, teachers, cadres, and workers responded to the proposal, among them were Guangzhou's vice-mayors Luo Peiyuan, Chen Anliang and others.

This eye bank, under the direction of Professor Du Nianzu a cornea transplant specialist, has advanced equipment, including equipment to store the live cornea for from 4 to 5 days to over a year. For the past few years, there have been about 200 successful transplant operations every year, accounting for more than one-third of the national total, with a 90 percent success rate, some attaining international levels and receiving the attention of opthalmology departments from around the world. Qian Zhangzhu, an English national of Chinese descent who was blind in the left eye due to corneal disease, 4 years ago could not be cured abroad, regained 0.2 vision in his left eye after an operation at this hospital.

According to the estimates of medical specialists, China now has approximately 2 million people who are blind due to corneal disease, and most of them could regain sight after an eye transplant. However, due to the influence of old ideas those willing to donate their eyes after death are few. For this reason, the specialists have recommended that in the course of constructing a socialist spiritual civilization, the donation of eyes after death to benefit the blind be vigorously advocated.

CSO: 4008/137

LIFE SCIENCES

SHANGHAI COLLEGE ESTABLISHES TWO STRAINS OF CANCER CELLS WHICH CAN BE CONTINUOUSLY TRANSMITTED

Shanghai WEN HUI BAO in Chinese 19 Mar 82 p 1

[Text] The pathology, physiology, and biophysics faculties of the First College of Medicine at Shanghai basic medicine department successfully established two strains which can be continuously transmitted--one a mouse viral lymphocytic leukemia and the other an abdominal fluid ascites or hydroperitoneal tumor model. Until now, the former had been transmitted for 87 generations, and the latter for 344 generations, and the growth characteristics are basically stable. This scientific achievement recently received the approval of the Ministry of Public Health at the ministerial level.

Tumors are a common disease and seriously threaten people's health. Through clinical and experimental evidence, we know that the carcinomas, sarcomas, and leukemias found in many animals such as frogs, chickens, rats, cats, cattle, monkeys, and baboons can be caused by virus. Research into the causes of leukemia viral disease is one breakthrough for discovering the causes of tumors, and the mouse leukemia model is a useful tool for investigating the causes of viral disease. In 1965, this medical college established a strain of mouse viral lymphocytic leukemia which can be continuously transmitted from generation to generation, which for the past 17 years, has been transmitted for 87 generations. In 1971, again successfully established a mouse lymphocytic hydroperitoneal tumor strain, which has already been transmitted for 344 generations, and has been selected by many units in China as an experimental model for scientific research.

By means of the detailed investigation of the biological characteristics of mouse leukemia and hydroperitoneal tumor, and the isolation of the viruses and their preliminary purifaction, we have proved these two tumor strains and the viruses isolated from them both have a direct relationship to studies of the cause and incidence of these diseases.

CSO: 4008/139

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9717
CSO: 4008/138

AUTHOR: FAN Tianwei [2868 1131 5588]

ORG: Computing Center, Chinese Academy of Sciences

TITLE: "A Method of Estimating the Derivatives Applied to Curve Fitting"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 1-11

TEXT OF ENGLISH ABSTRACT: The piecewise cubic Hermite interpolation is effectively applied to curve fitting, especially to computer curve output. The derivatives required in the interpolation are often obtained from the given data points by estimation. Akima proposed a geometric condition to estimate the derivatives of the function defined by these points, but its accuracy is frequently unsatisfactory. This paper provides an algorithm for estimating the derivatives based on a local procedure of cubic polynomial. Generally, the error of this algorithm and Akima's, except for two points closed to the ends, is in a ratio of about one to several hundred. When compared with Akima's procedure, the number of operations of this algorithm is larger, but in a special case of uniform mesh for single-valued functions there is little difference between them.

AUTHOR: FENG Baipei [7458 0130 1014]

ORG: Shanghai Institute of Computing Techniques

TITLE: "The Gear Program for Solving Initial Value Problems in General or Stiff Ordinary Differential Equations"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 12-23

TEXT OF ENGLISH ABSTRACT: In this paper, a procedure to realize the Gear method is given. It can be used to solve the initial value problems in general or stiff O.D.ES. with order 12 or 6 respectively. It may start and select step size automatically and make the corresponding change of order. The Jacobian matrix of right-hand side functions of the equations may be given by users directly or by procedure automatically. Moreover, in this procedure, the coefficients of the formula are stored in a special form so that the program is shorter and the storage needed is less.

AUTHOR: PEI Lucheng [5952 7773 2052]

ORG: Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Application of Adjoint Monte Carlo Method to Shielding Calculation"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 24-30

TEXT OF ENGLISH ABSTRACT: There exist some difficulties or problems if the general Monte Carlo method is used for the shielding calculation. This paper intends to give two methods, namely, adjoint statistical estimation method and adjoint exponential transformation method, with which these problems can be solved successfully. The practical calculation shows that the efficiency of these two methods can be raised over one to six times as compared with general statistical estimation method and general exponential transformation method.

AUTHOR: WEI Ziluan [7614 4793 7019]

ORG: Computing Center, Chinese Academy of Sciences

TITLE: "A Modified Algorithm for the Generalized Upper Bounding Problem"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 31-38

TEXT OF ENGLISH ABSTRACT: This paper presents a modified algorithm for generalized upper bounding problem (GUB). It consists of two main parts. In the first part, the formulas for computing the simplex multipliers and the reduced costs are derived. In the second part, the dynamic block pivotal method, presented by Kahn, is used to solve GUB problems. Finally, the computing steps of the algorithm are described.

AUTHOR: WANG Zeyi [3769 3419 3015]
SUN Jiaguang [1327 1367 1684]

ORG: Both of Qinghua University

TITLE: "A Solution of Linear Algebraic Equations for Orthogonal Elimination and Non-orthogonal Elimination of Mixed Mold"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 39-47

TEXT OF ENGLISH ABSTRACT: A new triangular elimination approach is proposed in this paper. The orthogonal mold elimination (fast Givens transformation) and non-orthogonal mold elimination (Gauss elimination) can be compatibly used, so that the amount of multiplication and division is between Gauss elimination and Householder transformation. This paper proposes the method of reducing extremely the amount of the orthogonal mold elimination so that the total operation is almost equal to the Gauss approach. We prove that the elimination procedure of mixed mold can be realized by using the method of two precedently orderings. The numerical stability in the third section is analyzed. At the end of this paper the results of tens of examples tested are given.

AUTHOR: SHAO Yuhua [6730 3022 5478]
BAO Guangde [7637 1684 1795]
YAO Yunfu [1202 0061 3940]

ORG: SHAO of the Computing Center, Chinese Academy of Sciences; BAO of the Fourth Ministry of Machine Building; YAO of the Institute of Electronics, Chinese Academy of Sciences

TITLE: "Computation of 2-D Magnetostatic Fields by Finite Difference Method"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 48-56

TEXT OF ENGLISH ABSTRACT: In this paper, the physical modeling for the permanent magnets and the finite difference method is described. The system of finite difference equations is solved by the method of relaxations. Numerical experiments show that the computed results are satisfactory.

AUTHOR: WANG Qizhong [3769 0796 1813]

ORG: Xi'an Institute for Optics and Precision Mechanics, Chinese Academy of Sciences

TITLE: "An Applied Program Packet for Optical Design"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 57-62

TEXT OF ENGLISH ABSTRACT: This paper describes a design idea of an applied program packet for optical design, the structure of the leading program, the calling method and the function of some main programs within the program packet.

AUTHOR: WU Huamo [6762 5478 6206]

ORG: Computing Center, Chinese Academy of Sciences

TITLE: "Elementary Proof of the Schur-Cohn-Miller Theorem"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 63-64

TEXT OF ENGLISH ABSTRACT: This note provides a practical modification of the Schur-Cohn-Miller theorem about the location of the roots of polynomials of the second order with complex coefficients. An elementary proof of this theorem is given.

9717
CSO: 4009/285

AUTHOR: WU Zhishan [0702 5267 1472]
SUN Tianzong [1327 1131 4912]
LIU Yunliang [0491 0336 5328]

ORG: None

TITLE: "The Processing and Geological Interpreting of Digital Data From Landsat"

SOURCE: Changchun CHANGCHUN DIZHI XUEYUAN XUEBAO [JOURNAL OF CHANGCHUN GEOLOGICAL INSTITUTE] in Chinese No 4, 82 pp 62-69

ABSTRACT: The authors used the "101 digital image processing system" to carry out many types of processing on 2 satellite tapes. The 101 system is produced by the International Image Systems (I^{2}S) of the Stanford Technology Corporation (STC) of the USA. It consists of special hardware and software which can process the Common Computer Tape (CCT) of the multi-spectral scanner (MSS) of the American Land Satellite (LANDSAT). The hardware consists of the HP3000 CPU, the M70 image processor, the C4500 digital scanner, and assorted accessories. The software includes many special subroutines. The article describes in some detail the terrain covered by the tapes, including the area around Chengde and the Great Wall north of Beijing. The image processing is described as consisting of 3 main steps: (1) Image recovery; (2) Image enhancement; (3) Image analysis. The results of image enhancement vary a great deal, with different images. Many methods of image enhancement are discussed. The first of these is reflectance expansion, which

[continuation of CHANGCHUN DIZHI XUEYUAN XUEBAO No 4, 1982 pp 62-69]

involves the emphasis of the statistical distribution of luminosity. According to the features we wish to enhance there are various transfer functions which allow each image element's original gray level (x) to be transformed into a gray level (y). Examples are given. Another method is color enhancement. This is important because the human eye has a much greater power to discriminate colors than gray levels. The method of proportional values is discussed, as is the method of wave filtering. Several matrix transformations which illustrate filtering principles are presented. The 5th method of image enchancement discussed is the KL method, also called the analysis of major components and is based on the statistical nature of the image. Several methods of image classification are also discussed, including cluster analysis which is carried out by the CLUSTER subroutine, and minimum distance analysis which is carried out by the MINDIST subroutine. The article concludes that the 101 system is quite advanced and meets many needs, and the enhancement methods are effective.

AUTHOR: YANG Xianzhi [2799 0341]

ORG: None

TITLE: "Some Improvements in the DSJ-18 Computer"

SOURCE: Changchun CHANGCHUN DIZHI XUEYUAN XUEBAO [JOURNAL OF CHANGCHUN GEOLOGICAL INSTITUTE] in Chinese No 4, 82 pp 113-118

ABSTRACT: The DSJ-18 (also called the 6912) Computer is a Chinese made medium scale, general purpose digital computer. There are currently something over ten of them in China. It is useful for all kinds of scientific computing involving large amounts of data. In the course of using and maintaining the machine a number of insufficiencies were discovered and corrective action was taken. The paper describes these problems as involving 3 areas: the interrupt structure, the internal memory timing, and the print routine of the diagnostic program. There was a problem in the operational unit in that electrical power could not be randomly increased and decreased. It often could be increased but not decreased. This had an especially big influence on tape drives. This was one of a number of problems that were identified as relating to the interrupt structure. A fairly complex procedure for fixing the interrupt problems is described in great detail. A great deal of attention is paid to the effort to speed up the computer by reducing the internal storage cycle time. The computer has the capability of executing instructions at an effective rate of 120,000 per second. This derives

[continuation of CHANGCHUN DIZHI XUEYUAN XUEBAO No 4, 82 pp 113-118]

from a cycle time of 480 nanoseconds and the fact that the average instruction (with proper weights given for the most frequently used instructions) takes 17.5 cycles. The main factor influencing the speed of computation was found to be not on the control unit but in memory. It was discovered that the basic operational cycle could be speeded up to 400 nanoseconds, increasing the effective rate of computation to 140,000 operations per second. The article discusses the problem of the print routine of the diagnostic program. The problem was considered to derive from the fact that the diagnostic program was not sufficiently complete and required excess manual intervention. The software and hardware improvements which fixed the problem are described in detail.

6168
CSO: 4009/264

AUTHOR: GUO Jingen [6751 6855 1649]
ZHOU Shaobo [0719 1421 2672]
GAO Qingshi [7559 1987 3740]

ORG: All of Institute of Computer Research, Chinese Academy of Sciences

TITLE: "A High-Level Language Oriented Multi-Processor Architecture"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 2, Feb 82 pp 1-6

ABSTRACT: This article proposes a multi-processor system which directly executes high level language systems. It points out the disadvantages of the traditional von Neumann machine with its single processor and common storage of data and instructions. Operating systems were developed which made these machines much more effective but software complexity obstructed progress and multi-layers of software hid the complexity of the hardware from the user. Layers of program changes caused the machine language program to lose correspondence with the high order language. The various difficulties in achieving optimum performance with traditional computers are traced to 2 sources: The first is the contradiction between the changes in the external characteristics of the computer and the internal system structure; the second is the lack of correspondence between the external language and the internal system. The execution of any high level program includes the language processing, the functional operation, and the control of the operational program.

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 1-6]

The system structure proposed here is designed with a modular structure based on these characteristics of the high order language. This structure includes (1) the LP [language processor] including the local memory, simple arithmetic logic unit, and the console, which can connect the LP with the B-Bus or the B-Bus with the PCP; (2) The PCP [program control processor] including the LOCM [local memory] and CU [control unit] which includes an 8 or 16-bit arithmetic logic process; (3) ALP [arithmetic logic processor] including the control unit, ALU and various multiplexers; (4) MM_i [data memory] which is independent of the PCP; (5) PM [program memory] using external storage; (6) IOP [the input-output processor]; (7) SP [special dispatch]; and (8) System traffic, which the A-Bus ties together PCP_i with M_i, and the B-Bus ties together LP_i and PCP_i, and the C-Bus ties together the various PCP's and IOP's. This structure overcomes many of the shortcomings of traditional computers and allows a high performace to be achieved at a much lower cost, and raises the utilization of resources. Every executive program has its own PCP, resulting in an independent control stream, thus avoiding the management problems of traditional operating systems.

AUTHOR: SHEN Xubang [3088 4872 2831]

ORG: Shaanxi Microelectronics Research Institute

TITLE: "A Special Purpose Signal Computer Architecture"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 2, Feb 82 pp 7-12

ABSTRACT: Although the microcomputer is widely used, its system architecture limits its application in digital signal processing, especially real-time applications. However, recent advances in semi-conductor technology provide the basis for the resolution of this problem. For example, the Intel 2920 is a single board ANALOG microcomputer suitable for real-time digital filtering. The American Microsystem S 2811 and the NEC D 7720 use multiplier arrays to increase processing speed. There is also the CORDIC microcomputer announced in 1980 and developed by the US Navy. It is used for trigonometric and hyperbolic functions, and can perform high speed coordinate transformations. The CORDIC arithmetic involves a mathematical technique which allows a wide range of transcendental functions to be implemented by simple set of iterative equations. These techniques especially lend themselves to the capabilities of microcomputers. The CORDIC technique also makes it easy to implement to DISCRETE Fourier transform (DFT.) The DFT can be viewed as a sum of rotated complex vectors. CORDIC techniques can be used to accomplish the rotation. As in most computers, in 77 type computers addresses are formed in the cpu. However, if address calculation is performed in a separate address control

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 7-12]

unit, we can relieve the demands on the ALU, speed up the processing,and meet the address calculation needs of digital signal processing. This facilitates the implementation of the FFT [Fast Fourier Transform.] In order to facilitate the use of the signal processing computer the user is provided with the FFT statement. Its function is implemented by a program constructed from corresponding FFT instructions. The 77 type machine is composed of 2 components: the control memory and the arithmetic logic unit. This paper discusses extending this to 3 main parts: an expanded control memory, an ALU with parallel shift transmission, and an address control unit. This will enable a computer so organized to cover the area of application of both microcomputers and signal processing computers.

AUTHOR: CHEN Junqiang [7115 0193 1730]
DENG Shuzhen [6772 2611 3791]
XIE Jinguang [6200 2516 0342]
WANG Yizhong [3769 0110 1813]
ZHANG Guanhua [1728 0385 5478]
HU Qiwei [5170 0366 5588]
HAN Zongbao [7281 1350 5508]

ORG: All of Shanghai Research Institute of Physiology, Chinese Academy of Sciences

TITLE: "A Microcomputer for Data Processing in Neurophysiological Research"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 2, Feb 82 pp 31-37

ABSTRACT: Every kind of biological phenomenon displays bioelectrical activity but the laws of such activity are very difficult to master. For example, the human brain contains 10 billion neurons and any kind of neural activity activates electrical impulses of the neurons. In order to record this activity we put electrodes in the scalp. Computers are necessary to make sense of the mass of data so gained. In 1980, we developed a bioelectrical data processor (BDP.) The heart of the system was the single board Z80 Starter System, with expanded RAM and EPROM, a special keyboard and input-output and display unit. This article describes the design concepts and concrete implementation of this system. The special characteristics of bioelectrical data processing include the following: all kinds of processing is required; processing methods are continually advancing and changing; researchers require interactive control; the scale of current of biological research is not large;

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 31-37]

and it requires a cost effective system. Based on these requirements, a number of design criteria were arrived at: a complex processing capability must be built out of basic processing steps; a monitor program residing in EPROM must be interfaced with utility programs; the program must be maintainable and modifiable; a microcomputer will provide the heart of the system. Using a single board microcomputer which costs 300 yuan and is expandable, the system can be built cheaply. The starter system used the 8-bit Z80 microprocessor, which includes the entire 8080 instruction set, making it easy to use 8080 software. This board is fairly complete. Aside from the CPU and 1 K RAM, it includes the parallel input/output Z80 PIO and the Z80-CTC timer circuit. It has a magnetic tape and a 28-key keyboard as well as a 2 K monitor in ROM. The RAM and ROM were expanded to a total of 16 K bytes. Two K bytes of RAM were used to hold bioelectrical data and processing results, 1/4 K held a run time monitor, and 5.75 K were used for data collection and utility programs, etc. Design of the system started in Mar 80 and it was basically completed in Dec and placed in operation in the bio-laboratory. The hardware all performed to standard. The system control program commonly used utility programs in EPROM totaled 7 K bytes. The operation of the system under laboratory conditions proved that the system design was reasonable, had great potential, and was suitable for the needs of scientific experimentation. The design concepts were relatively new, specialized, and cost effective. After the system was placed in the laboratory, the urgent need for new programs was revealed. We are now producing programs which are helping to raise the standard of biological research to approach international standards.

AUTHOR: LI Daokai [2621 6670 1956]

ORG: Institute of Computer Research, Chinese Academy of Sciences

TITLE: "A Discussion of Some Problems of the Power Systems for Large Scale Computers in China"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 2, Feb 82 pp 38-50

ABSTRACT: Third generation computers in China, like the 013, the HDS-9, etc. adopted 400 cycle or 1000 cycle medium frequeny alternating current generators. The main advantages are: it provides good isolation from the power net; it is reliable; and alternating current generators are relatively mature products. As computers advanced, the electrical requirements increased. In the 60's in the rest of the world an uninterruptible power source (UPS) composed of a 3-phase inverter, storage batteries, and diesel generators was adopted. The storage battery could provide 15 to 30 minutes of power, after which, if needed, the diesel generator could be started. Because of its various advantages, this system was produced in China. China can now supply 50 cycle 3-phase inverters of 50 and 100 KVA, and 400 cycle inverters of 15 KVA. The circuits are third generation. Fourth generation circuits are being developed. Some people (especially experts in China) feel that most computers do not need UPS. It is only necessary to implement the CVCF (constant voltage, constant frequency) system. Abroad, there is a preference for CVCF over UPS. The

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 38-50]

Chinese made BP-30 and BP-1000 medium frequency generators have been in practical use for over 10 years and proved to be reliable but the one defect is noise, generally above 90 db. This is not only a threat to maintenance people but interferes with the work people nearby. A direct current constant voltage source is the heart of a computer's electrical system. In order to improve electrical quality and decrease transmission interference as much as possible, this power source is often installed on the same board as the logic unit. Generally speaking, computers require a high reliability electrical source, with a high efficiency. In order to improve power source technology, experts in China and abroad are striving to find new and more effective techniques. A number of developments are noted. One of these is the use of rectifier filter direct current sources. Because the requirements of computers for direct current stability is not high, many countries adopt simple rectified current with filters as the computer power source. The CDC Cyber 172 uses this. The magnetic amplifier source is discussed. Also, at present many computers are using transformed direct current sources. At present a great deal of attention is being paid to shrinking the volume of the power source, raising reliability, and diminishing interference. Raising the frequency is an effective method and abroad frequencies of 200 KC is not novel. The unipolar motor is low voltage, high current equipment and meets the requirements of computers. The article concludes with a discussion of grounding considerations.

6168
CSO: 4009/277

AUTHOR: LUO Junyang [5012 0193 2254]
SUN Yue [1327 6390]

ORG: None

TITLE: "A Study on the Maximum Thrust Nozzle Surface of Solid Rocket Engine for One-Dimensional Two-Phase Flows"

SOURCE: Beijing BINGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 82 pp 1-9

ABSTRACT: Based upon the Pontryagin's maximum principle, this paper studies the problem of optimal thrust nozzle surface for one dimensional two-phase flows. Using the slope as the control variable, the optimal surface is proved to be a conical surface, formed by a rectilinear system with the slope as a constant. Methods for defining the optimal contour of the subsonic and the supersonic segments are also discussed. The paper concludes that in designing the thrust nozzle surface of one dimensional two-phase flows, the smallest possible value should be selected for the convergent half angle α of the subsonic segment, the greatest possible value should be selected for the expansion half angle β of the supersonic segment.

AUTHOR: GU Jifa [7357 1015 4099]
GU Junfang [7357 0193 2455]

CRG: None

TITLE: "Multiobjective Decision of Parameters for the Suspension System of a Wheeled Vehicle"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 82 pp 30-37

ABSTRACT: Based upon the random vibration theory, there are several different control standards to choose from for establishing the suspension system of a vehicle. As the optimization technique is becoming more popularly applied in engineering design work, it has also been introduced to resolve the problem of selecting parameters of the suspension system. The authors start with a mathematical model of an optimized design. Due to the fact that it is relatively difficult to find a solution to a multiobjective problem directly, scientists have proposed many methods to transform it into a uniobjective problem. A method of the sum of linear weighting, a method of object formulation, and a method of the ideal point are introduced by the authors for the transformation before obtaining the optimized solutions on a computer. The mathematical model, the optimization procedure, and sample parameters are given.

AUTHOR: MA Xieqi [7456 3610 0967]

ORG: None

TITLE: "Comments on the Plateau Combustion Mechanism of Double-Base Propellants"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 82 pp 48-57

ABSTRACT: Theories comcerning plateau combustion mechanism of double-base propellants, proposed by scientists of the USA, USSR, Japan, Great Britain, etc. are divided into 2 major categories for review purpose in the paper: the subsurface coacervation phase theories and the gaseous phase theories. The first category is further divided into the photochemical reaction mechanism, the chemical equivalent shift theory, the chelation theory, the location and mechanism of activity of catalysts studied with the spectroscopic method, thermal decomposition-gaseous phase chromatographic studies, mass spectrographic analyses, differential calorimetric experiments, determination of explosion point to obtain activation energy, and results of surface temperature measurements. The second category is further divided into the lead-lead oxide cycle theory, the free base theory, the carbon-containing substance-the heated bright ball theory, the lead-carbon catalysis theory, the π bond complexing theory, the thermal plateau microscopic studies, and the theory of reaction unrelated or not greatly related to pressure. Proposals under each subcategory are commented separately and the 58 references, in which these proposals originally appeared, are provided. Finally, several viewpoints of the author concerning the direction of future researches on the subject are presented.

6248
CSO: 4009/266

AUTHOR: None

ORG: None

TITLE: "National Laser Electron Beam Heat Treatment Technology Discussion Meeting"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 1, 1982 p 26

ABSTRACT: The National Laser Electron Beam Heat Treatment Technology Discussion Meeting was held in Changchun from 29 Oct to 1 Nov 81, with 82 delegates representing various places of the nation. The conference received 27 papers. The delegates analyzed the condition of development of laser heat treatment in foreign countries and discussed the domestic conditions and problems of the field. They agreed that the technique has its special characteristics of saving energy, being free of pollution, high production efficiency, and minimal deformation of products. The technique is especially suitable for articles of complex shape and for surface hardening of a portion of an article of a relatively large size. CO_2 laser tube of less than 500W is believed to be sufficient to satisfy production needs but laser devices of more than 2000 W would be even more suitable. At present CO_2 laser devices of the 3-5 kw class should be developed and on that basis, experimental research and production application of such processes as alloying, glazing, coating, etc. should be carried out. The delegates suggest that a comprehensive research center should be established to organize the production of complete sets of laser tools and to supply them to the production units.

AUTHOR: ZHANG Dekuan [1728 1795 1401]

ORG: Talian Freezing Machinery Plant

TITLE: "Several Viewpoints Concerning Specialized Production of Heat Treatment in Talian City"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 1, 1982 pp 32-34

ABSTRACT: Tailian is an industrial city of many industries, including machinery, petroleum, chemicals, instrumentation, electronics, metallurgy, shipbuilding, textiles, and whatnot. In the process of further readjustment of the national economy, the heat treatment industry, which exists to serve the aforementioned industries, is also undergoing readjustment. The current problems of the heat treatment industry include excessively scattered plants, low rate of equipment utilization, low technological level, backward equipment, and low average technical and economic indices. Based upon these conditions, the author suggests that some plants that have few jobs, low technical level, and high energy consumption should be closed down. Others that have been linked with cold and hot production lines should continue. For some industries, such as vehicles, machine tools, shipbuilding, etc. a center for heat treatment may be established to gather together good engineers and skilled workers in one place, so that the level of production management and technology may be improved, the cost may be reduced, and the attitude of service for the other industries may be introduced. Within permissible limits, the system of awarding bonuses may be implemented.

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CSO: 4009/280

AUTHOR: DUAN Runsheng [4551 3387 3932]
MEI Zuyan [2734 4371 1750]

ORG: DUAN of Bureau of Hydroelectrical Power Construction, Ministry of Electrical Power; MEI Department of Water Conservancy, Qinghua University

TITLE: "All Characteristics of the Mixed-phase Flow, Reversible Pump Turbine"

SOURCE: Beijing SHUILI SHUIDIAN JISHU [WATER CONSERVATION AND HYDROELECTRIC POWER TECHNOLOGY] in Chinese No 2, 20 Feb 82 pp 34-40

ABSTRACT: On the enclosed gas etching test stand of the Hydraulic Machinery Laboratory of Qinghua University, the authors carried out a steady-state all property test of the mixed flow reversible pump turbine to determine its properties under all 5 operation conditions; i.e. the pump, the turbine, and the pump braking, the turbine braking, and the reverse pump conditions of the transitory process. The water flow characteristics of the various operation conditions are introduced. All property curves are used to analyze some transitory states of the reversible machine. Results of the test are found to be very close to the properties of similar machines in foreign countries. In the future, further studies may be carried out to use theoretical or semi-theoretical computation method to draw the all property curves and a great deal of time may be saved in designing reversible turbines.

AUTHOR: YANG Demao [2799 1795 5399]

ORG: Bureau of Water Conservancy, Department of Hydroelectrical Power, Fujian Province

TITLE: "Small Hydroelectric Power Resources in Fujian Province and the Condition of Their Utilization"

SOURCE: Beijing SHUILI SHUIDIAN JISHU [WATER CONSERVATION AND HYDROELECTRIC POWER TECHNOLOGY] in Chinese No 2, 20 Feb 82 pp 52-55

ABSTRACT: Fujian is an agricultural province of little land, numerous population, and a backward economy. It has no oil or gas and a small coal reserve. Its resources of small hydroelectrical power generation is the only objective condition for rapid development. Before the liberation, the province had 5 small hydroelectrical power stations of a total capacity of 505 kw. Now, it has more than 8 thousand stations of 677,000 kw of machine capacity, amounting to 21 percent of its total developmental potential. In the recent decade, the direction of development is toward expansion, linkage, and storage, depending mostly upon locally raised capital. The existing stations are mostly the runoff type, with great water volume variations. The supply and demand are often not in balance; the equipment utility rate is low; and accidents occur much too frequently. This paper describes the condition of development of small hydroelectrical power stations in Fujian, their economic indices, and the existing problems. Some solutions to the problems are briefly mentioned.

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CSO: 4009/279

AUTHOR: HAN Qiyong [7281 0366 0516]
WU Weijiang [0702 5898 3068]
FANG Keming [2455 0344 2494]
et al.

ORG: All of the Beijing University of Iron and Steel Technology

TITLE: "Determination of the Alloying Amount of Ce and Its Distribution in Steels by Radioactive Tracer Method"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 1-7

TEXT OF ENGLISH ABSTRACT: The steel samples containing cerium sulfide and cerium oxide traced by ^{141}Ce were electrolyzed to detect the stability of cerium sulfide and cerium oxide under the chosen conditions of electrolysis. The results of our experiments show that the decomposed amount of cerium sulfide and cerium oxide during electrolysis is extremely small, the former being $\leq$0.4 percent and the latter $\leq$0.027 percent. The measurements of the cerium content in the five kinds of steel show: if the original content of S and O in steel vefore the addition of Ce is high, there is almost no dissolved cerium in the low Ce content steels. The alloying amount of Ce increases with the increase in Ce content in steels, Experimental results show that the method used by former researchers for determining the alloying amount of the rare earths by the difference between the total rare earth amount in the sample and the rare earth amount in the inclusions is unreliable due to the segregation of rare earth inclusions in the steel.

[Continuation of GANGTIE No 2, 1982 pp 1-7]

Microautoradiographs show that the inclusions containing cerium are more concentrated in pearlite of the as-cast 25MnTiB steel. Ce is distributed in a strip shape within the grains of as-cast Fe-Cr-Al alloy. The concentration of Ce in the grain boundaries was not observed by autoradiography.

AUTHOR: YANG Kenu [2799 0344 0505]
SUN Congxi [1327 1783 3356]
SHEN Jianian [3088 0502 1628]

ORG: All of the Institute of Metal Research, Chinese Academy of Sciences

TITLE: "On the Reaction of Carbon-Oxygen and of Silicon-Oxygen During the Vacuum Smelting of Ultra Pure Ferritic Fe-Cr-Mo Stainless Steel"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 9-16

TEXT OF ENGLISH ABSTRACT: The effect of temperature, pressure and alloy concentration on the equilibrium of carbon-oxygen reaction for a ferritic Fe-Cr-Mo stainless steel was investigated. Results obtained by calculation show that either a lowering of the pressure or an increasing of the temperature promotes the carbon-oxygen reaction, but the presence of high chromium concentration retards the reaction. Similar calculation of the equilibrium value of silicon-oxygen reaction indicates that during the vacuum induction melting the concentrations of silicon and oxygen in the liquid bath closely approach their equilibrium values. From the calculated results it is concluded that the equilibrium concentration of silicon and carbon in the liquid steels is mainly dependent on the degree of vacuum employed as well as on the amount of oxygen present in the bath.

[Continuation of GANGTIE No 2, 1982 pp 9-16]

The experimental results obtained by electron beam melting and vacuum induction melting are cited to give rate values for the removal of carbon, silicon and oxygen respectively from the molten bath. It is shown that the rate-determining step for carbon removal is the diffusion of carbon across the boundary layer, whereas the rate of deoxidation by silicon depends mainly on the oxygen concentration in the liquid steel. Based on the above results certain suggestions to improve the technology of smelting have been proposed.

AUTHOR: WEI Tainxiu [7614 1131 4423]
CHEN Longgen [7115 7893 2704]
ZHOU Yisheng [0719 3015 3932]

ORG: All of the Central Iron and Steel Research Institute

TITLE: "A Water Model Study of Gas Injection in a Steel Ladle"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 17-22

TEXT OF ENGLISH ABSTRACT: A hydraulic model experiment has been carried out simulating powder injection into a 15 t ladle with argon. The effects of argon flow rate, lance position and nozzle configuration on the flow pattern of the liquid were studied. A KCl solution was used as a tracer for the measurement of time of mixing. The relationship between gas rate and depth of lance immersion has been obtained. The effect of lance location relative to the central axis of the vessel is discussed.

AUTHOR: SHAO Xianghua [6730 6272 5478]

ORG: Central Iron and Steel Research Institute

TITLE: "Technological Studies for the Extraction of Niobium and Manganese from Baotou Hot Metal"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 23-30

TEXT OF ENGLISH ABSTRACT: Hot metal from Baotou blast furnaces contains about 0.08 percent of niobium and 1 percent manganese. The open-hearth slag accumulated at that steel plant also retains appreciable amounts of these metals. A process has been developed, using a small blast furnace and side-blown converter for collecting niobium and manganese in the OH slag into an enriched intermediate slag, which is used as the raw material for the production of ferro-manganese-niobium. Methods were also experimentally studied for the direct extraction of niobium and manganese from the hot metal. It was found that by properly treating the hot metal in a converter, be it top-blown, side-blown or bottom-blown, at least 80 percent of the niobium and manganese is oxidized, producing a slag which is in effect an artificial niobiferrous manganese ore, that can be used for making niobiferrous ferro-manganese especially suitable for the production of niobium microalloyed high-strength steel. A bottom-blown converter is preferable to the side- or top-blown in that less of the phosphorous will go into the slag, thus simplifying the latter subsequent processing. A neutral lining (e.g., high alumina brick) would have the

[Continuation of GANGTIE No 2, 1982 pp 23-30]

advantage of longer life and higher Nb and Mn as well as lower P content in the slag produced. Large-scale tests of a continuous spray extraction process pointed toward considerable potential advantages over the intermittent converter processes.

AUTHOR: LIN Zongcai [2651 1350 1752]
ZHOU Rongzhang [0719 2837 4545]

ORG: Both of Beijing University of Iron and Steel Technology

TITLE: "Selective Oxidation of Niobium and Some Other Related Elements in Liquid Iron"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 31-35

TEXT OF ENGLISH ABSTRACT: Recovering niobium from hot metal is a process of complex selective oxidation. Based on the work of the authors' research group, this paper deals with the niobium oxide formed in slag, the oxidation of elements in liquid iron, the optimum temperature of selective oxidation for recovering niobium, the influence of (FeO) upon selective oxidation, the length of oxygen jet in the bath, the time for perfect mixing in the bath, and gives some useful conclusions.

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AUTHOR: XU Jiadong [1776 1367 2767]

ORG: Beijing Industrial University

TITLE: "The TP801-Z80 Single Board Microcomputer"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, 82 pp 5-9

ABSTRACT: In order to promote the use of microcomputers the Beijing Industrial University, in cooperation with the Jingye Company of Hong Kong, has developed an inexpensive and efficient TP801-Z80 single board microcomputer. It can be used for process control, instrumentation, and data processing as well as in distributed processing. The major characteristics are as follows: It uses the Z80 CPU; the clock cycle is 1.9968 MHz, making it convenient for use with an 8080 interface circuit. The 4K bytes of RAM is composed of 8 2114 chips; 2K bytes of ROM include the TPBUG-A monitor; 4K bytes of PROM or EPROM can be selected. The I/O is carried out through the Z80-PIO; there are 2 8-bit programmable I/O ports; there is a Z80-CTC arithmetic timer unit. There are 28 keys, 16 of which are hexadecimal keys and 12 are command keys, including 8 dual function keys. The Z80 CPU is described in some detail, such as the fact that it has 158 basic instructions, including the 78 8080 instructions. Its addressing scheme and interrupt structure are outlined. Memory organization is described in some detail, such as the fact

[continuation of DIANZI KEXUE JISHU No 2, 82 pp 5-9]

that ROM locations 0-07FFH (i.e. 7FF hexadecimal) contain the monitor and locations 800-F 17FF contain utility programs. The MOVE, LAST, AND DISP commands are described in some detail. The article concludes that the TP801 can satisfy many industrial needs, but efficiency of using machine language in the editing and testing of programs is low. The TP80 series, TP803, can overcome these contradictions.

6168
CSO: 4009/269

AUTHOR: ZHOU Zhike [0719 1807 4430]

ORG: Chaoyang Xinsheng Asbestos Mine

TITLE: "Research on the Reconstruction of the Technical Process of Chaoyang Asbestos Ore Dressing Plant"

SOURCE: Beijing FEIJINSHU KUANG [NONMETALLIC ORES] in Chinese No 1, 28 Feb 82 pp 6-9

ABSTRACT: The Chaoyang Asbestos Deposit is an underground mining site. As the production advances toward the deeper parts of the deposit, the condition of the ore reserve, the quality, the fiber length, and the asbestos elasticity are all changing while the water content of the ore is increasing. These conditions have been giving some difficulties to the ore dressing process. Based upon the physical properties of the ores, the reconstructed dressing process is divided into the 2 parts of ore preparation and the crude ore refining process. At present, due to the great differences of ore characteristics produced from the various asbestos mines in China, the dressing processes are becoming more and more complex. The reconstructed Chaoyang Dressing Plant is designed for an annual production of 8,000 tons. Although it remains a small scale plant, the dressing equipment used in the selection and purification processes is designed and made by the plant itself. This special characteristic has caused the work procedure to be simplified yet the goal of separating the asbestos fiber from the gangue and the powdery dust is achieved. A flow diagram of the reconstructed process is included.

AUTHOR: ZHANG Yuhong [4545 5940 1347]

ORG: Research Institute, Geological Company, Ministry of Construction Materials

TITLE: "Preliminary Investigation on the Technique of Dressing the Wollastonite of the Taye-Yangxin Region of Hubei Province"

SOURCE: Beijing FEIJINSHU KUANG [NONMETALLIC ORES] in Chinese No 1, 28 Feb 82 pp 10-14

ABSTRACT: In foreign countries, Wollastonite or tabular spar ($CaSiO_3$) has been used as an industrial raw material for 2 to 3 decades; in China, the discovery of industrial scale deposits of this mineral is only a matter of very recent years. With the development of the national economy, there is a need of accelerating the production of glazed tiles for which Wollastonite is a relatively ideal raw material. Based upon foreign reference materials, including those of the USA and the USSR, the author and colleagues completed some preliminary experiments on dressing the ores produced in the Taye-Yangxin region. This paper includes a description of the general characteristics of the ores, results of spectroscopic semi-quantitative analysis, results of chemical analysis, the thermal properties of the ores, and the contents of harmful foreign substances. The experimental dressing formula and the results are reported. There is also a brief report on the experimental application of the dressed mineral to make glazed tiles.

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CSO: 4009/282

AUTHOR: WU Minda [0702 2404 6671]
NI Shuhuai [0242 2885 2849]

ORG: Both of Zhejiang University

TITLE: "The Method of Panoramic Moire Topography"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 3-9

TEXT OF ENGLISH ABSTRACT: This paper presents a new method which is called panoramic Moire topography. This method can take a 360° panoramic topograph of an object with a synchronous slit camera while the object is rotating about its center relative to a fixed flat grid. The principle and method for generating panoramic topography are described. The formulas, error analysis of contouring fringes and the experimental devices are explained. We get the panoramic topography of the "boy's head" model and the conic cylinder by this method. The comparison of the experimental values of the conic cylinder with the theoretical values shows that the error is less than ±0.05 mm.

AUTHOR: HUA Zhongyi [5478 0022 0001]
ZHUGE Jian [6175 5514 0256]
PAN Xinglong [3382 2502 7893]

ORG: All of Fudan University

TITLE: "Resonant Photoelectron Appearance Potential Spectroscopy"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 10-17

TEXT OF ENGLISH ABSTRACT: Excitation of core-level electrons may occur through a resonant absorption of characteristic X-rays from a built-in X-ray tube with an anode made of the same material as that of the sample. Auger electrons may be generated during the deexcitation process. By measuring the total yield of photoelectrons as a function of anode voltage, a new type of appearance potential spectroscopy (APS), the resonant photoelectron appearance potential spectroscopy (RPAPS), is obtained. Compared with the soft X-ray APS, RPAPS has the advantage of better sensitivity for the sub-peaks of principal element and peaks for the impurities under the same operating condition. RPAPS causes no damage to the sample, therefore it can be used in the whole range of energy of APS. Results from pure nickel and nickel alloys are given for demonstration.

AUTHOR: JI Xizhang [0679 3356 4545]

ORG: Beijing Institute of Aeronautics

TITLE: "Some Aspects of Analog Input Channel"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 18-26

TEXT OF ENGLISH ABSTRACT: Analog input channel is one of the crucial parts in the utilization of computers for automatic measurement and control. Currently there are practical difficulties remaining to be resolved in the hook-up of the component to certain systems. During the development of the G3 Data Acquisition/Processing Control System, we experienced these difficulties also, and present them in this report as follows: The analog switch is the fundamental part of the channel. We adopted a tube-type, opticoelectrocoupling-MOS circuit analog switch. In theory, this is an ideal type for the analog switch. Its performance has been confirmed by our practice. During the test-runs of the G3 system, we found that the channel interference phenomena persisted. After conducting substantial tests and careful analyses of the results, we came up with a way of suppressing the interference. Tests were performed and summarized for the key factor, the temperature coefficient, of the transducer's constant-current source that might affect the measurement accuracy. We find that the temperature coefficient would depend on performances of the operation amplifier. The success of choosing an appropriate amplifier

[Continuation of YIQI YIBIAO XUEBAO No 1, 1982 pp 18-26]

enables us to resolve the difficulty in the application of a new type of semiconductor transducer. Through experiments we have come up with a way to prevent voltage overloading. By the four pairs of transistor modulating/demodulating analog switches in the data amplifier, we found that the selection and distribution could simply be carried out according to the reversed current amplification coefficient.

AUTHOR: QIAN Zhongtai [6929 6945 3141]

ORG: China National Institute of Metrology

TITLE: "The Combination Method of the Limit Values of Error"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 27-33

TEXT OF ENGLISH ABSTRACT: This paper proves that the rule of square sum is valid for the combination of the limit values of the terms of probability distribution, thus solving a protractedly debated problem in the theory of error. The analysis in this paper is based on three premises: (1) It is recognized that the outlier may occur, but its influence on the quality of measuring results is small. (2) The quadratic moment of outlier is introduced to replace the probability of outlier (or confidence level) and should be regarded as a major mathematic index for estimating the degree of seriousness of the outlier. (3) It is believed that the considerably large values occur in the error terms, which seriously deviate the normal distribution, with little probability. Moreover, when estimating the reliability of combination methods, the influence of this probability is taken into consideration.

AUTHOR: QIAN Shinan [6929 4258 0589]
WANG Jinghua [3769 2529 5478]

ORG: Both of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "The Optical System Design of a Versatile Laser Interferometer"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 34-39

TEXT OF ENGLISH ABSTRACT: Making use of the advantages of lasers, we have developed a versatile polarized laser interferometer of high precision but with simple operation. A quarter wave-plate and polarizing beam-split prism system is applied so that this instrument can adjust the contrast of interference fringes and eliminate the adverse effects of the stray light reflected from surfaces of the interferometer. The design of this instrument and some of its experimental results are given here. The method of realizing uniform inclination interference measurement with one of the interchangeable objectives of testing the spherical mirror, the apparatus of quick fringe acquisition and the double rhomboid-prism alignment system designed for operating with ease are also described.

AUTHOR: HONG Rutong [3163 3067 2717]

ORG: Sichuan University

TITLE: "An Analog Optical Method for Image Equidensity Level Slicing"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 40-46

TEXT OF ENGLISH ABSTRACT: Recently, optical image processing with its ability for parallel-processing, large data capacity and low cost has become a prominent branch of image processing techniques. In this paper, a halftone technique applied to equidensity-level-slicing of wider density thickness in order to isolate the specified density area of an input image is described. This method is different from that previously used where a one-dimensional-halftone screen (S_2) consisting of rectangular halftone cells is chosen. The halftone screen (S_1) chosen here consiste of halftone cells with nonmonotonic and abruptly jumping characteristics which can perform pulse-frequency-modulation on the input, thereby achieving the transformation from the specified density to the special frequency. Thus, by using a quasi-coherent processing system, the special filtering to abstract the specified density areas can be accomplished. The hard-clipping preprocessing consists of using the halftone screen of fundamental frequency 7.51 p/mm, spatial-frequency-product 450, "So" high-contrast film and "D_8" developer. The experimental results

[Continuation of YIQI YIBIAO XUEBAO No 1, 1982 pp 40-46]

of the equidensity abstracted from a satellite remote sensing image are shown in the pictures. What we want to achieve by level slicing is an ideal rectangular intensity transfer function (ITF). However, since the hard-clipping property of the film used is by no means ideal and the line blooming is unavoidable in the halftone picture, the level slicing ITF actually obtained had to be degraded. In this work, the level slicing ITF of the one-step film copying process of S_1, S_2 and the slice density thickness is measured experimentally. The degree of degradation of ITF for S_1, S_2 is determined individually by comparison with the ideal ITF. The comparison of the level slicing performed by S_1, S_2 demonstrates that the quality of level slicing ITF has been improved and the line blooming has been reduced. Judging by the experimental results of the equidensity abstracted from the satellite remote sensing image, the corresponding boundaries of gray steps are clear. This proves that these slices are independent and there is no cross-over. Therefore, the original purpose of isolating the specified density area has been achieved. From this work we see that this method of level slicing by using halftone technique may be successfully applied in other regions.

AUTHOR: ZHOU Zuoquan [0719 0155 3123]

ORG: Guilin Institute of Electrical Appliances, First Ministry of Machine Building

TITLE: "An Analysis and Design of Binary-to-N-nary System Decoding Network with Voltage-stabilizing Supply"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 47-56

TEXT OF ENGLISH ABSTRACT: The binary-to-N-nary system decoding network with voltage-stabilizing supply may be classified into four types: ladder-ladder, ladder-weighting, weighting-ladder and weighting-weighting.

In this paper, a new method of analyzing the decoding network has been established. In comparison with the previous methods, the advantage of the present one is its simplicity. In addition, it can be used for general purposes. A series of design formulas are described. Some examples are given to make this method more available.

AUTHOR: JIE Bingxin [2263 4426 C207]

ORG: Huazhong Institute of Technology

TITLE: "The Theoretical Analysis and Calculation of Magnetic Modulator"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 57-63

TEXT OF ENGLISH ABSTRACT: At present the magnetic modulator is very extensively applied to the precise instruments of electrical measurement, but the theoretical analysis on the magnetic modulator as of yet has not been quite perfect. Two simple analytical methods, the breaking line method and the hyperbolic function method, are presented and are compared through analysis. The hyperbolic function method has been shown to have a more guiding effect in practice.

AUTHOR: XU Weizheng [1776 4850 6927]
BAO Xuecheng [0545 1331 6134]
ZHENG Quan [6774 2938]
ZHUANG Songlin [5445 2646 2651]

ORG: XU of the Shanghai Photocopier Manufacturing Factory; BAO of Shanghai Jiaotong University; ZHENG of Shanghai University of Science and Technology; ZHUANG of Shanghai Institute of Optical Instruments

TITLE: "An Investigation of the Auto-design Method for the Primary Construction of Optical Systems"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 64-68

TEXT OF ENGLISH ABSTRACT: This paper introduces a method of automatic design for the primary construction of optical systems. This method is based on Delano's y-$\bar{y}$ mathematical model and employs the statistic test method with iteration process. By using this method satisfactory results have been obtained. In this paper, the mathematical method, construction of merit function and use of the program are discussed in detail, and the calculated results are also given.

AUTHOR: ZHOU Kaiyi [0719 7030 0310]

ORG: Beijing Central Iron and Steel Research Institute, Ministry of Metallurgical Industry

TITLE: "An Automatic Hollow Cathode Light Source Device for Emission Spectrum"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 69-75

TEXT OF ENGLISH ABSTRACT: The theory and practice of the ZKG-1 automatic hollow cathode light source for the emission spectrographic determination of trace elements in steels, high temperature alloys, nonferrous metals and superpure substances are described in detail. The questions investigated include high voltage electrical source unit for constant current output, dynamic equilibrium-type vacuum system and program control system. Supplying a hollow lamp with pulse current or a combination of pulse current and direct current can improve the limits of detection for some elements. When He is replaced by Ar on the cheap, spectral emission intensity of a large number of trace elements is changed insignificantly. The absolute limits of detection for a large number of trace elements are 10^{-6}~10^{-11} g. The relative limits of detection are 10^{-3}~10^{-6} percent. A coefficient of variation detected is 10~50 percent.

AUTHOR: ZHU Guoyi [2612 2654 6654]
WANG Erkang [3076 1422 1660]

ORG: Both of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

TITLE: "A Multi-purpose Neopolarograph"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 76-84

TEXT OF ENGLISH ABSTRACT: A multi-purpose neopolarograph system has been designed. The system consists of recording i-E, m-E, e-E, e'-E, e''-E and cyclivoltammetric curves, where m and e are semioperators, the semiintegral and semidifferential, e' and e'' are the 1.5th order and 2.5th order differential. The principles, construction and experimental results are given. It shows that the sensitivity, resolution, reproducibility and rapidity of the system are satisfactory.

AUTHOR: NI Weidou [0242 4850 2435]
PENG Rong [1756 1369]

ORG: Both of Qinghua University

TITLE: "State-space Mathematical Model of Split-shaft Gas Turbines and a General Computer Program for Dynamic Study of Control System"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 85-94

TEXT OF ENGLISH ABSTRACT: The gas turbine is a nonlinear, multi-input and multi-output power system. The increase of the number of shafts and the number of control parameters, together with their corresponding control loops, makes the gas turbines as a control object more and more complicated. This paper presents a study of the dynamic behavior of split shaft gas turbines with regenerator and adjustable nozzles by the modern control theory. With the detailed consideration of the physical phenomena which take place in transient response, five differential and six algebraic equations describing the dynamic behavior are deduced and, through some special transformations, a mathematical model of split shaft gas turbines in state-space form is obtained. On the basis of this state-space mathematical model, this paper presents a common computer program for the dynamic study of different split-shaft gas turbines with different control rules. This mathematical model may also be used for the optimal control of split-shaft gas turbines.

AUTHOR: LI Shutian [2621 2885 3944]

ORG: Beijing Analytical Instrument Institute

TITLE: "Prospects for Process Analyzers of the 80's"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 95-101

TEXT OF ENGLISH ABSTRACT: The process analyzers (PA) are undergoing rapid changes. In this paper, the most important trends of development of PA are reviewed for the purpose of giving a general picture of the PA of the 80's. The application of microprocessors in the design of PA is most fascinating. It will be extended to a lot of simpler, monocomponent PA, such as pH meters, ion activity meters, conductometers, nondispersive IR gas analyzers, etc., for correcting baseline shift, calibrating, data processing, compensating for errors resulting from changes of background composition of sample and environmental conditions, controlling instrument operation and monitoring instrument working status, etc., in the next few years, although their use today is primarily limited to several types of multicomponent PA. With the exception of the gas chromatograph, the use of process multicomponent analyzers, especially liquid chromatographs, mass spectrometers, multicomponent IR analyzers and X-ray analyzers, will grow quickly. More and more efforts have been directed toward the exploitation and development of simple selective direct probes. The weakness of early developed direct probes was

[Continuation of YIQI YIBIAO XUEBAO No 1, 1982 pp 95-101]

lessened or overcome due to the adoption of microcomputers. The most attractive direct probes include ion-selective electrodes, solid state electrochemical transducers and optical probes. Composite probes integrated with microcomputers with the ability of eliminating complicated interference influence by mathematical compensation will be available. Another noteworthy trend is that great attention is paid to system design and the auxiliary parts of the analyzer systems. "Prepackaged analyzer systems" were born in time, and some changes in the concept, technology and hardware designs of sampling and sample pretreatment are expected to take place.

9717
CSO: 4009/286

AUTHOR: QIN Guogang [4440 0948 0474]
DU Yongchang [2629 3057 2490]
ZHANG Yufeng [1728 3768 1496]

ORG: All of the Department of Physics, Beijing University

TITLE: "Simultaneous Measurement of Profiles of Deep Levels and Shallow Impurities with the C-V Method"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 89-94

TEXT OF ENGLISH ABSTRACT: The measurement of the profile of deep levels in semiconductors as well as that of the profile of shallow impurities is a problem of great importance. We suggest a procedure for measuring simultaneously the profile of deep levels and shallow impurities with the C-V method. The results are especially accurate when the density of the deep levels is comparable to that of shallow impurities. The principle and method of measurement is presented and we give results of measurements on an N^+-P junction of gold-doped silicon and on a Schottky barrier of VPE N-type GaAs.

AUTHOR: XU Shunsheng [6079 7311 3932]
XU Jingyang [1776 2529 7122]
TAN Ruhuan [6223 0320 3883]

ORG: All of the Shanghai Institute of Metallurgy, Chinese Academy of Sciences

TITLE: "Investigation Methods of Lapping and Polishing Damages in Single Crystal Wafers by X-ray Double- and Triple-crystal Diffractometry"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 95-101

TEXT OF ENGLISH ABSTRACT: Methods using X-ray double- and triple crystal diffractometry for the investigation of lapping and polishing damages in single crystal wafers have been suggested. Depth of lapping damage in semiconductor wafers can be measured quantitatively by double-crystal diffractometry and successive etching of wafer surface. The quality of polishing of single crystal wafers can be detected non-destructively by double- or triple-crystal diffraction methods, and comparison can be made between different ways of polishing. No change over of reference wafer is required in the proposed triple-crystal diffraction method when polishing quality of various kinds of specimen wafers is to be examined quickly and effectively.

AUTHOR: ZHANG Xiumiao [1728 4423 8693]

ORG: Department of Physics, Fudan University

TITLE: "Rapid Determination of Bulk Generation Lifetime and Surface Generation Velocity by Saturation Capacitance Method"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 102-106

TEXT OF ENGLISH ABSTRACT: A new rapid method for determining bulk generation lifetime and surface generation velocity is suggested on the basis of the analysis of a MOS capacitance C-t transient response to a linear voltage sweep. Both the experimental procedure and the calculation involved are relatively simple, therefore the method is more suitable for cases in which measurements of lifetime and surface generation velocity of a large number of samples are necessary.

AUTHOR: GE Yuru [5514 3768 1172]
GAO Shufen [7559 3219 5358]
WANG Li [3769 5461]
et al.

ORG: All of the Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "A Study of Doping Effects on 1.3 μm InGaAsP/InP DH Laser by means of SEM and V-I Characteristic"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 107-112

TEXT OF ENGLISH ABSTRACT: The doping effects on the position and properties of PN junction in 1.3 μm InGaAsP/InP laser by means of SEM and V-I characteristics are studied. It is considered that Zn vapor contamination during the epitaxial growth and Zn fast diffusion of Zn doped InGaAsP, InP crystals is the dominant cause for PN junction deviation and that a high concentration of donor or acceptor dopant will result in a tunneling-type of PN junction. Therefore, in the fabrication technology of lasers, control of Zn contamination and dopant concentration is of extreme importance.

AUTHOR: WANG Shouwu [3769 1343 2976]
ZHAO Liqing [6392 4409 1987]
ZHANG Cunshan [1728 1317 0810]
DENG Shenggui [6772 3932 6311]

ORG: All of the Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "The Dependence of the Electro-optical Delay Time on Injection Pulse Current in DH Lasers and Their Measurements"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 113-119

TEXT OF ENGLISH ABSTRACT: The expression for the dependence of the electro-optical delay time on the injection pulse current level and the front edge rise time was derived. The measurement of a stripe-type DH laser made by proton bombardment has been carried out by using the measurement system designed by us. For device 90-15#, at the current level 1.5 times the pulse threshold current ($I = 1.5\ I_{th}$), the electro-optical delay time t_α was measured to be 4 ns, and the spontaneous recombination lifetime, $\tau_{\Delta p}$, was 3.2 ns. Some measurements were carried out with a DC bias. For several additional devices more results have been obtained. It can be seen that the measured results agree well with the theoretical ones.

AUTHOR: QU Baochun [1448 0202 2504]

ORG: Changsha Institute of Equipment for Semiconductor Technologies

TITLE: "Development and Application of LC3 Ion Implanter"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 120-126

TEXT OF ENGLISH ABSTRACT: This paper presents a discussion on the physical design of LC3, and describes the main problems in the process of adjustment together with methods for solving them. It also gives a brief description of the results of adjustment and of the application of this implanter.

AUTHOR: ZHUANG Wenjun [5445 2429 0689]

ORG: Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "Automatic Selection of Basic Units in LSI CAD Mask Making"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 127-135

TEXT OF ENGLISH ABSTRACT: This article describes the automatic selection of basic units during CAD mask making with double platen pattern generator and it puts forward an object function for basic units selection and an approach for the comparison between the two parameter sets used to differentiate mask graph units. It also suggests two basic partition models of mask graph units and the concept of the minimal integral partition threshold for their control. Finally, it discusses the logical process of automatic selection and the incorporation of all equivalent graph sets during the process.

AUTHOR: SUN Huiling [1327 1979 3781]
CHEN Ming [7115 7686]
WANG Peida [3769 1014 1129]

ORG: All of the Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "Study of High Dose Nitrogen Ion Implanted Layer on Silicon Surface"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 136-140

TEXT OF ENGLISH ABSTRACT: This paper presents a study of the high resistivity layer formed by high dose nitrogen ion implantation on silicon surface. This study will be helpful in adopting ion implantation in the isolation technology for semiconductor integrated circuits.

N-type monocrystalline silicon with resistivity of 0.5 Ω-cm and <111> orientation is used as a substrate. The implantation energy used is 80 keV with high dose $1\sim2 \times 10^{17}$ cm^{-2}. After the implantation and annealing, a high resistivity layer with good stability in physical, chemical and electrical properties is formed on the surface of the substrate.

The crystal structure and the stoichiometry is analyzed by means of Auger electron spectroscopy (AEX), Rutherford channeled and nonchanneled backscattering, infrared Fourier spectrometer and X-ray photoelectron spectroscopy.

[Continuation of BANDAOTI XUEBAO No 2, 1982 pp 136-140]

The results prove that the implanted nitrogen ions have a Gaussian-shaped distribution and the amorphous nitride layer may consist of a matrix of silicon nitride and silicon.

The same results can be obtained by high dose nitrogen ion implantation on P-type 8~10 Ω-cm silicon surface.

9717
CSO: 4009/288

AUTHOR: LIN Shichang [2651 0013 2490]
XIAO Naiyuan [5618 0035 0337]

ORG: Both of the Institute of Electronics, Chinese Academy of Sciences

TITLE: "Experimental Studies of Electron Beam Welding of Alumina to Niobium"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 129-134

TEXT OF ENGLISH ABSTRACT: Experiments on the electron beam welding of alumina to niobium were carried out to obtain long-life ceramic-metal joints subject to corrosive working medium at high temperatures. Research on the design of welded components and on the technology of preheating and welding was made. Results of the performance tests of the welded joints were given. The mechanism of this type of EB welding was preliminarily analyzed.

AUTHOR: TAN Changying [6223 7022 3841]
ZHOU Zhaowei [0719 2507 0251]
GE Xuelian [5514 1331 1670]

ORG: All of the Harbin Research Institute of Welding

TITLE: "An Inquiry into the Rational Notch Depth of the Implant Test Specimen"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 135-142

TEXT OF ENGLISH ABSTRACT: The present report summarized the work on the susceptibility to hydrogen embrittlement of steel by C.L.M. Cottrol, F. Watkinson, et al., utilizing round notched tensile test specimens in a chamber filled with high pressure hydrogen. The specific type of implant test specimen as recommended by IIW (round specimen, 8 mm diameter, 40° notch, <0.1 mm root radius, 0.5 mm notch depth) was analyzed and its shortcomings cited. The influence of notch depth on notched tensile strength of 15MnVN steel in the normalized, thermal-simulated and welded states was investigated.

In this paper the authors present an expression D for the susceptibility of steel to hydrogen induced cracking, as indicated by the difference in reduction of notched tensile strength caused by hydrogen, i.e.,

$$D=\frac{\sigma_{NT}-\sigma_{1\text{ app.}}}{\sigma_{NT}}\cdot 100\%.$$

[Continuation of HANJIE XUEBAO No 4, 1981 pp 135-142]

The authors also give an example of taking the D value as a criterion for comparing two different postheat procedures and choosing the one suitable for making certain welded pressure vessels free from hydrogen-induced cracking.

AUTHOR: ZHANG Zhiming [1728 1807 2494]
ZHONG Guozhu [6945 0948 2691]
XU Zaicheng [1776 0375 2052]
et al.

ORG: All of the Harbin Institute of Technology

TITLE: "Study on the Delayed Cracking of Ultra High Strength Steel"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 143-151

TEXT OF ENGLISH ABSTRACT: The hydrogen induced cracking and the stress corrosion cracking in weld joints of 37SiMnCrMoV steel are investigated by means of four-point bending test and surface crack test respectively. High environment humidity increases the susceptibility to hydrogen induced cracking and stress corrosion cracking. Scanning electron microscope fractography shows the intergranular character of hydrogen induced cracking. The effect of microstructure of HAZ (partially melted zone and quenched zone) on cracking susceptibility is studied by the scanning electron microscope and optical microscope. Welding procedures are adjusted to prevent brittle failure of high pressure vessel.

AUTHOR: LI Deqing [2621 1795 3237]
YU Shansong [0205 0810 2646]
YANG Zhenhua [2799 3791 5478]

ORG: All of the Beijing Research Institute of Material and Technology

TITLE: "Study on the Automatic Regulation of TIG Welding Arc-length"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 152-160

TEXT OF ENGLISH ABSTRACT: The arc-length control device for TIG welding described in this paper has a closed-loop circuit voltage control and an open loop circuit servo-motor speed control. It is simple in construction and reliable in service. The servo-motor, powered by a transistor bridge, suffers no trouble from relay contactors and, therefore, makes the life of the device much longer. The amplification factor of this system is over 10^6 and the accuracy of voltage control is within ±0.114 V.

The static process of arc-length regulation has been analyzed, thus providing a theoretical basis for the design of an apparatus of this kind. The production experience in the past two years has proved that this device is a very useful tool for TIG welding.

AUTHOR: ZHOU Guangde [0719 1684 1795]
LIN Da [2651 6671]

ORG: Both of the Institute of Electrical Engineering, Chinese Academy of Sciences

TITLE: "The Design and Analysis of Electron Optical System for Electron Beam Welding Machine"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 161-170

TEXT OF ENGLISH ABSTRACT: In this paper, the physical factors of the formation of an electron beam spot in an electron optical system were analyzed. Through complicated analysis and calculation we obtained the basic rules of choosing a convergent half angle, an optical system and lens parameters, and learned their effects on the beam spot size. The said analysis and calculating method are also useful for the design of the electron optical system of EB welding machines.

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BEIJING-WUHAN MICROWAVE COMMUNICATIONS LINE BEING TESTED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9,5 May 81 p 14

[Article by Zhou Hongshun [0719 7703 7311], head of the Beijing-Wuhan Microwave Engineering Technology Section of the Ministry of Electric Power: "Our Nation's First PCM Digital Microwave Communications Line"]

> [Text] The entire project passes through Hebei, Henan, and Hubei Provinces and Beijing city, and connects the communications channels of the North China Power Network, the South Central Power Network and the Communications Dispatch Center of the Ministry of Electric Power to provide a communications channel for electricity production in those provinces and city and for water conservancy and flood prevention in the Huanghe and Changjiang River valleys.

The Beijing-Wuhan PCM digital microwave communications line, organized and constructed by the Ministry of Electric Power, is 1,263.75 kilometers long with 34 stations (3 terminal stations, 12 telephone down line stations, 2 regenerative relay stations, 17 heterodyne relay stations) and 33 zones (29 single receiving zones, 4 space diversity receiving zones). The total capacity is 480 telephone lines. This line is one of the few most advanced in the world today. The transmission line of this system--including computers, the whole design for construction including the towers, machine rooms, power source and auxiliary communications facilities of lightning arresters and grounding--were all developed domestically by ourselves. The main communications equipment and related instruments were imported from NEC of Japan. After the signing of the contract with NEC and Kokuyo Denki on 31 January 1979, our nation sent technical personnel to Japan to learn digital microwave circuit design, digital microwave communications theory and installation, testing and maintenance. During that time, they learned testing techniques at Anritsu and Sanei Testing Equipment Company, and they visited the Tokyo Electric Power Company, the Chubu Electric Power Company, the Kansai Electric Power Company, the Nippon Telephone and Telegraph Public Corporation and the Japanese National Railways to gain experience in managing communications facilities and operation. At present, under the Ministry of Electric Power and its Communications Bureau, workers and Japanese experts have basically completed installation of the equipment and testing single units together, and now they are carrying out on-line testing of the whole line. It is expected that by the second half of 1981, the whole line can begin test operation.

The structure of this system is based on related CCIR and CCITT international standards; consideration was given to the characteristics of communications networks specifically for power systems, and so the 2 GHz frequency was used. The gain of the 4-meter-diameter parabolic antenna is 36 decibels. The loss per meter on the soft coaxial feed line is 0.045 decibels. The output power of the transmitter is 30 decibels. The sensitivity of the receiver is 3.5 decibels. The 4 PSK modulation and synchronous coherence modulation are used. The relay is heterodyne of 70 MHz medium frequency. The PCM base group uses CEPT (32 TS, A rhythm, 13 breaking lines) and the rate is 2.048 megabits-second. It has a sound frequency transmission interface, a high-speed digital transmission interface and a low-speed digital transmission interface, and it can be connected to direct dialing telephones, switchboard and extension phones, magnet phones, phones connected to teletypewriters, secure phones, and dispatching phones. It can also transmit stationary images, information in analog-digital form and telemechanic data, computer data, relay protection information and telegraphic data. The second and third groups use asynchronous positive code rate adjustment and grouping of signals. The rates are respectively 8.448 megabits/second and 34.368 megabits/second. The allowable error is respectively $\pm 20 \times 10^{-6}$. The impedance of the interface between the first, second and third groups is an imbalanced 75 ohms. The code form is HDB_3 or AMI. The whole machine is built from structured components and assembled in a building block manner. The alarm signals are complete and the automatic circling function is strong. This makes it easy to determine breakdowns and to maintain.

Consideration was given to the characteristics of electricity production, and it was decided that the information transmitted via the communications lines of the electric power system must be versatile, accurate, superior in quality, and reliable. Therefore, when designing the Beijing-Wuhan digital microwave line, current international criteria for most reliable transmission were used. This means that over a 2,500-kilometer standard analog line, during any month of serious attenuation, the time factor of the error code rate surpassing 1×10^{-6} is guaranteed to be below 0.01 percent. The number of free communications channels remaining basically approaches the standards for "large communications lines." The antenna towers for the whole line are vertical towers. The tallest is 84 meters and the shortest is 32 meters. There are a total of 32 such towers. The system can operate under unmanned conditions in the future. The microwave transmitter and receiver and modulation-demodulation equipment are thermal backup units. Optimum automatic selection of the main microwave channel and the backup wave channel is realized by the no-hit bit composite switch. The whole machine is made of solid state components, and the amplifying components are integrated. Via the supervision and control equipment (NAR7501/7502), the system can perform three-level (station, central station of the province, headquarters in Beijing) supervision along the whole line. The central station of the province can carry out remote control of all subsidiary stations--for example, starting and shutting down the oil-fired generators. In addition, the headquarters in Beijing also has central monitoring facilities (NSV-85A), consisting mainly of a microprocessor (μPD8080), main memory (64K bytes), flexible disc (250K bytes) and typewriter, paper tape punch, paper tape readout, screen display, and business phone. This facility has the following programs: monitoring program, FEP processing program, CPU processing program, BEP processing program, support program, decision program, and applications program. Thus, the system can

automatically gather and store information on the status of each station along the whole line at any time; it can access, record, and display their status at any time and supervise and control operations along the whole line in a timely manner.

The Beijing-Wuhan microwave system runs through three provinces and one city (Hebei, Henan, Hubei and Beijing city). It connects the communications channels of the North China Power Network and the South Central Power Network with the Communications Dispatch Center of the Ministry of Electric Power. It provides a communications channel for the production of electric power in those provinces and city and for water conservancy and flood prevention in the Huanghe and the Changjiang River valleys. At the same time, by extending this system and its branch lines in the future, the communications channels of the electric power networks of Eastern China, the Northwest and the Southwest can be connected, forming a telecommunications loop and network. This is very important for strengthening the safe and economic operation of the electric power system, improving the level of automation of the electric power network, and gradually improving the backward situation in technical management of the electric power industry. Also, completion of this microwave trunk line will benefit the levels of education, scientific research, manufacturing, engineering, operation and management in digital microwave communications technology in our nation.

Many years of positive and negative experience have shown us that an electric power system closely related to the life of the people of the nation is similar to the nation's railroad system. We must insist on building an independent and modern dedicated communications network. Generally speaking, the commercial communications network cannot match the structural complexity of the electric power system. The quality of information transmission of commercial telecommunications networks cannot adapt to the safety requirements and economic requirements of electric power production. The management and technology of commercial telecommunications networks and dedicated communications networks are also very different. All this has been proven by objective reality, as well as by the experience of many nations with developed electric power industries and technology.

The Beijing-Wuhan digital microwave communications system is a necessary product of the development of our nation's electric power production. It will play an increasingly important function in electric power production.

9296
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DJS 200/XT1 COMPUTER OPERATING SYSTEM DESCRIBED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 15,5 Aug 81 p 6

[Article by Fei Xianglin [6316 5046 2651] and Tan Yaoming [6223 5069 6900] of Nanjing University: "The DJS 200/XT1 Operating System"]

[Text] Software and Service

The DJS 200/XT1 (abbreviated XT1) operating system is a general-purpose operating system developed for the domestically manufactured 220 model and 210 model computers of the DJS 200 series of computers. It has two versions, the XT1G (using the magnetic drum as the backup memory) and the XT1P (using the magnetic disc as the backup memory).

The design of the XT1G was completed in 1978, and debugging was completed in 1979. It passed inspection and evaluation in December of the same year. The evaluation pointed out: "It is a general-purpose device. It is simple, versatile and convenient to use. It possesses upward compatibility and it has reached a new level in the nation." The article introducing the system was read at the "computer science conference" held in February 1980 in Kansas City in the United States. The paper received praise. Computer scientists in the United States and Hungary wrote to ask for information concerning the paper on the XT1. In July 1980, an article on that system was published in the OPERATING SYSTEMS REVIEW, the organ of the American Computer Society.

I. Function

The XT1 performs the following main functions:

1. The operating system organizes, controls and manages writing operations in various languages. The system operates in two modes, one under automatic control and one under direct control. During the course of execution, the user can use functional commands or operating commands to change the control mode of operation any time.

2. Pre-input and slow output (spooling). The operator can input operations in batches into the computer system. The system processes the operations in batches. It allows parallel operations by four to six users. The system provides corresponding virtual equipment to realize batch processing. This shortens the operating time, increases the amount of intake and output, and improves the system's efficiency.

3. File management. The system can manipulate files on magnetic tape, on magnetic drums, on magnetic discs and files in various items of peripheral equipment. The user can conveniently use the general commands provided by the system to realize storage, search and revision of information on various pieces of equipment.

4. Management of internal memory. The system uniformly manages and controls information stored in the internal memory. During the execution of operations, the system can dynamically request and return information stored in the internal memory. This makes it convenient for the user and also improves the rate of utilization of the internal memory.

5. Management of terminals. The system allows multitasking in many ways, such as in the conversational mode, remote input and real-time data collection.

6. Interrupt processing. The system has a relatively strong interrupt processing capability. It processes interrupts at three levels during the execution of operations, i.e., it processes them by turning to the user program, it processes them according to the requirements stipulated in the operations manual, and it processes them according to the system's standard procedures.

II. Characteristics

During the development of the XT1, attention was given to gaining new ideas in the designing of operating systems abroad and the experience in our nation, and at the same time, consideration was given to its compatibility with other operating systems of DJS 200 series machines and various languages. Efforts were also made to satisfy the different needs of many types of users as much as possible. The whole system possesses the following characteristics:

1. Level structure. Level structure is a relatively advanced structure for operating systems. The functions of the XT1 are realized by the internal core and the procedures located on each level. Communications methods are used between procedures to realize internal communication (see ELECTRONICS JOURNAL, No 2, 1980, "The XT1 Operating System").

2. Mixed synchronization mechanism. The XT1 uses a mixed synchronization mechanism. This mixed synchronization mechanism consists of a primitive communication language, priority dispatching and a list rea ing/list writing primitive language. This not only effectively realizes synchronism of the processes and assures sharing of the source data, but it also allows the system to operate at a low cost and to be built easily.

3. Multiple dispatching strategy. To improve the system's efficiency, different dispatching strategies have been used according to the characteristics of various data sources. The data which can be distributed to the peripheral equipment for processing are distributed under a strategy combining stationary distribution and dynamic distribution to improve the rate of utilization of the equipment. The order of accession of the shared data source on the magnetic drum is optimized using the "shortest distance" method, and the waiting time for accessing the read and written information is reduced. The magnetic discs use the "escalator method" to reduce the expenditure in moving the arm. The data source in the internal memory is stored using a dynamic relocation demand assignment system. This improves the rate of utilization of space in the internal memory to the largest extent. When scheduling in and scheduling out, the strategy of first-in first-out, which occupies the least amount of internal memory, is used for processing user operations in order to conserve the use of the backup memory. When an operation is being processed, the system does not select new operations for storage in the internal memory so as to avoid unlimited delay in one operation.

4. Less internal memory use. The XT1G has about 23K bytes of memory. Because the overlay technique is used, the permanently stored data occupy only 6K of internal memory--less than 10 percent of the total internal memory (usually, total internal memory is 64K).

5. Greater versatility. By simply adding or reducing the number of modules it can be adapted to the various hardware configurations and needs of users.

6. Better accuracy. Many measures have been used to avoid deadlocks. The system has been logically proven that it will not produce deadlocks. (See the JORNAL OF NANJING UNIVERSITY, National Sciences Edition, No 2, 1978, "A Method to Prevent Deadlocks")

7. Convenient to use. The user can operate and run computational problems after brief and simple training.

III. On-Line Debugging of the XT1G

The first version of the XT1 operating system passed the on-line debugging evaluation with standard FORTRAN in December of 1979 (designed by the state-run Beijing Wire Communications Equipment Plant). It passed on-line debugging evaluation with COBOL in December of 1980 (designed by the Nanjing University, the Nanjing Wire Communications Equipment Plant, et al). Recently, it successfully passed on-line debugging with expanded FORTRAN (designed by Beijing University, Shanghai Computer Plant), and was evaluated in May 1981. It is currently undergoing on-line debugging with compiler languages and it will continue to undergo on-line debugging with ALGOL, so that the DJS 200 series will gradually form a computer system with complete software support and the operating system will be convenient to use.

IV. Brief Report on the XT1P

The XT1P operating system is the second version of the XT1 operating system. It inherited the system structure of the XT1G, but its functions have been expanded. The expanded functions of the XT1P over those of the XT1G are mainly: magnetic disc management, magnetic disc file management, management of terminals slow output and automatic scheduling of the compilation system for different languages.

The XT1P also has the capability for batch processing and time-shared processing. It can control six batch processing operations or it can simultaneously operate with terminal operations. It can support compilation systems for eight languages, and it can provide multitasking terminal operations in the conversational mode, remote operation input mode and real-time data gathering.

The XT1P provides a common access magnetic disc file and a dedicated magnetic disc file for the user. The common access file serves as a temporary file for many users to store data simultaneously. The dedicated magnetic file serves as a storage file for one user alone. The user can establish a dedicated file as a permanent record.

The XT1P has many methods of file organization for the convenience of the user. It has a sequential file, a direct access file, an index file, an indirect file, an indexed sequential file, and a drum sorted file.

The XT1P and XT1G are compatible. Information processed under the control of the XT1G can be processed under the XT1P without any modifications.

The development of the XT1P is in progress. Debugging is scheduled for July 1981, and its application is expected in 1982.

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CSO: 4008/123

HAJIF-II PROGRAM SYSTEM DESCRIBED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 3, Mar 82 pp 2-4, 19

[Article by Guan Te [4619 1795]: "An Introduction to HAJIF-II--A Program System for the Dynamic Analysis of Aircraft Structures"]

[Text] HAJIF-II is a program system developed under the direction of the Chinese Aeronautical Establishment (CAE) for performing dynamic analysis of aircraft structures. It can carry calculations of fundamental dynamic characteristics of structures (e.g., fundamental frequencies and modes), as well as flutter calculations and gust response calculations for an airplane with active control systems.

HAJIF-II was developed on the Ximengzu-7760 computer. The development started in November 1979, and was completed in July, 1981; in November 1981 it was certified by the CAE. Participants in the development were members of the Third Ministry of Machine Building and the five Institutes of the CAE.

Development of HAJIF-II not only followed the general guidelines for designing large program systems such as reliability, generality, flexibility, automated operation, high efficiency, ease of modification and expansion, and diagnostic capability, but also incorporated new ideas to make the program as practical as possible. During the system design, a number of new methods were developed, and new results published in foreign journals during the 1970's were used. All of these new techniques were tested and verified before implementation. For problems which require research and exploration, considerations were given to as many different approaches as possible. Techniques which had been proven to be effective in actual engineering use were collected; and only those mathematical and mechanical formulas which were specifically designed for airplane applications were incorporated.

In performing calculations of fundamental dynamic characteristics, the structure can be considered either as a single body or as a synthesis of several substructures; it can be simulated using the dispersed finite-element model or can be approximated by simple

beam models. For flutter and gust response calculations, the method of modal superposition is used.

The structure can be divided into 99 substructures, each with as many as 7000 degrees of freedom. As many as 300 panels can be used in the calculation of non-steady aerodynamic forces, and 50 modes can be accomodated in flutter and gust response analysis.

The program contains 31 prescribed computational flows. There are 7 in the fundamental dynamic characteristics calculations (representing the integral structure method, the fixed-interface single-level synthesis method, the free-interface single-level synthesis method, the fixed-interface multi-level synthesis method, the free-interface multi-level synthesis method, the fixed-interface successive synthesis method, and the free-interface successive synthesis method), 2 in the flutter calculations (representing the V-g method and the p-k method), 1 in gust response calculations, and 21 for calculating the combined effects of fundamental dynamic characteristics, flutter, and gust response. There are approximately 26000 FORTRAN instructions in the system.

A general description of the system will be presented below.

1. Data Generation

One of the problems in using the finite-element method to analyze large structures is the large amount of labor required in data preparation. From the user point of view, it would be desirable to have automatic data generation capability. Since modern airplanes generally have wing spans with small aspect ratios and irregular arrangement of structural components, it may not be feasible to generate structure data using overly simplified methods; also, the results may not meet the accuracy requirements in verification calculations. Therefore, in HAJIF-II, provisions are made to have the flexibility of either manual input of numerical data or automatic generation of data via topological description. In addition, since the user with a small or medium size problem generally does not have a large amount of data, he may not want to take the trouble of learning the language for topological description of structures; therefore, two different forms of input have been designed: simple numerical data input and mixed input.

2. Element Storage

The use of finite-element method to simulate airplane structures requires proper storage of the elements. There are 12 different types of elements in the element storage of HAJIF-II. Each element contains a stiffness matrix and a mass matrix. The primary design considerations of the element storage are based on the requirements of simulating the wing surface, the fuselage, the suspended objects, and their inter-connections. In addition

to the commonly used rods, plates, and spars, consideration is also given to the possible use of simple beam structure to simulate the wing surface; therefore, a special beam element is also included.

3. Stiffness and Mass Matrices

The calculation of fundamental dynamic characteristics is based on the following equation:

$$k\,u = \lambda m\,u \qquad (1)$$

where k,m are respectively the stiffness matrix and the mass matrix; λ is the square of the frequency, and u is the fundamental mode. In general, solution of this equation is obtained by iteration, which requires repeated use of the matrices k and m. Therefore, the effective management of k and m is a key element in improving the computational efficiency . In HAJIF-II several measures are taken to achieve this goal.

In selecting the degrees-of-freedom of nodes, a variable degree-of-freedom technique is used. In other words, the number of degrees-of-freedom is not fixed, but rather is determined by the number of elements connected to the node. As a result, superfluous degrees-of-freedom are eliminated.

For multi-level structures, nodal renumbering and bandwidth optimization techniques are used to reduce the bandwidths of the k and m matrices.

The k and m matrices contain a large number of zero elements. In HAJIF-II modified hyper matrix technique is used so only the non-zero nodal elements are stored. Specifically, the k and m matrices are first divided into zeroth order submatrices; the zero and non-zero submatrices are denoted by zero plus non-zero elements. Clearly, the zero submatrices still contaon zero elements. Hence, the submatrices are then subject to "microscopic processing" using the concept of effective rows to further eliminate zero elements.

In HAJIF-II the nodal degrees-of-freedom can be contrained using either single-point or multi-point constraint techniques. The effect of single-point constraint is to simulate various boundary conditions and symmetric or anti-symmetric conditions by fixing the displacement of a particular degree-of-freedom. Multi-point constraint on the other hand is to control the relations among various degrees-of-freedom by expressing part of the degrees-of-freedom as linear functions of others.

4. Calculation of Real Eigenvalues

The solution of Equation (1) is accomplished using a simultaneous

iteration procedure (or subspace iteration procedure). During the design of HAJIF-II, a new algorithm was developed by combining the merits of various iteration methods currently being used. The new algorithm has the following features: (1) the mass matrix does not decompose, and remains unchanged; (2) vectors which have already converged are eliminated to reduce the number of vectors to be iterated; and (3) the computational procedure is improved. In comparison with existing methods, the new algorithm has the same rate of convergence, but each iteration involves less computations, thus resulting in higher computational efficiency.

5. Modal Synthesis

In the calculation of fundamental dynamic characteristics, the structure can be treated as a single body. But for large structures, it is desirable to divide the structure into a number of substructures and determine the fundamental dynamic characteristics of each substructure; the fundamental characteristics of the overall structure is then obtained by superposition. This results in higher computational efficiency. In some cases, repeated calculations are performed where only a subset of structural parameters are varied. For example, in the analysis of wing structure in conjunction with suspended objects or control surfaces,only the parameters of the suspended objects or control surfaces are varied. It is clearly uneconomical to repeat the calculations for the entire structure each time; it would be more efficient to use the method of modal synthesis.

The method of modal synthesis was developed in the 1970's; its application in this country is still in the infant stage. In HAJIF-II, not only the main branches of modal synthesis, i.e., the method of fixed-interface and the method of free-interface, were adopted, but two new methods of synthesis based on the concept of multi-level substructures were developed-- the method of multi-level synthesis and the method of successive synthesis, as shown in Fig. 1. In the method of successive synthesis, only one of the two substructures is analyzed to determine its fundamental characteristics; the other is directly synthesized using the equations of physics.

6. Non-Steady Aerodynamic Forces

Although modern airplanes can fly at supersonic speeds, most serious flutter conditions occur near sonic speeds at low altitudes. Currently, there is no reliable engineering method that can be applied to transonic lifting surfaces. Results based on subsonic wing theory can reflect basic flutter characteristics with reasonable accuracy. Therefore, a subsonic doublet lattice method is implemented in HAJIF-II to treat multiple wing structures in three-dimensional space.

The non-steady aerodynamic theories currently in use are primarily based on the assumption of sinusoidal vibration. Methods which can handle general non-steady lifting surfaces with non-sinusoidal vibrations are still of limited practical use. In order to treat non-sinusoidal vibration problems such as subcritical flutter response, an approximate method developed in the 1970's is used in HAJIF-II. This method uses an interpolating function to determine the non-steady aerodynamic forces in the Laplace plane based on sinusoidal solutions.

7. Flutter Calculation

In HAJIF-II, flutter characteristics are computed using the V-g method and the p-k method. With the p-k method, the effect of active control systems can be taken into consideration. The flutter problem is essentially a complex eigenvalue problem. In HAJIF-II three methods of solution are offerred: the complex QR method, the complex LR method, and the inverse power method with origin shift.

8. Calculation of Gust Response

The calculation of gust response in HAJIF-II is based on a continuous atmospheric turbulence model. By performing the analysis in the frequency domain, and taking into account the effect of active control systems, it can estimate the low-frequency vibration of the airplane, and also provide data for designing active control systems. The system can calculate the aeroelastic frequency response function of each node of the airplane structure, i.e., the amplitude and phase response under the action of a sinusoidal gust with unit strength. It can also compute the power spectrum and associated statistics of the response function corresponding to a given atmospheric turbulence model. Atmospheric turbulence can be simulated using a system-provided Karman power spectrum model or from user input.

9. Program Organization

The programs of the HAJIF-II system are organized into two levels. The first level is the executive program, which consists of almost exclusively transfer instructions. The second level consists of processing routines which are high-level subprograms controlled by the executive program and capable of independent calculations of prescribed mathematical and mechanical functions. No transfer of command is allowed between two processing routines. Each processing routine can only have input/output relations with a data base. This feature greatly improves the flexibility and efficiency in program debugging and testing, program termination and starting, as well as in flow organization and capability expansion.

In the executive program, a variable-length common data block is established for use by each processing routine. Except for a very small data block that can be generated by the individual processing routines, all other data must be allocated from this common data block. There are three different methods of allocation: static allocation, dynamic allocation, and mixed allocation. In the case of dynamic allocation, the concept of boundary-less data block is adopted.

For those sections which have relatively large internal storage requirements, the system can automatically judge the amount of required internal storage, and decide if external storage would be used. In this manner, the solution of both large and small problems can be carried out without sacrificing computational efficiency.

10. Data Organization and File Management

The entire data base of the HAJIF-II is called a "directory". It is composed of several files (whose number can be expanded); each file is divided into 100 records; and each record is divided into 100 blocks. The files are organized according to the individual processing routines. The records are designed to facilitate the analysis of the substructures; for example, the data of each substructure can be compiled into one record. A block is the basic unit of data management; it contains all the data associated with each instruction. Each block is denoted by its block address.

The file management system of HAJIF-II can perform the functions of file distribution and control of associated variables. For data exchange, the system can accomplish the READ and WRITE functions automatically by simply transmitting the input/output tables and addresses to the file management system.

11. User Interface

To use the HAJIF-II system, the user must supply three kinds of information: (1) mission document, (2) numerical data, and (3) topological description. In return, the system provides the following information to the user: (1) calculated results, (2) error messages, (3) name of the processing routine being executed, and (4) execution time.

Two kinds of user-oriented global instructions are available in HAJIF-II. One is used to initiate the 31 prescribed computation flows; the other is to allow the user to organize his own computation flow by transferring to the various processing routines. Both flow options can be executed either via batch processing or via interactive dialogue. The pre-requisite for using these two flow options is that the required data must be in a readily accessible data file.

HAJIF-II also provides the capability for error diagnosis. Since most errors are caused by errors in the initial data, the diagnostic procedure emphasizes the inspection of initial data, and the output of as many as reference messages as possible. In addition, the user can also request certain sophisticated and more time-consuming diagnostic procedures.

12. Sample Calculations

In order to test the performance of the system, calculations were carried out for a total of 56 test cases during the development of HAJIF-II. Of these cases four were synthesis calculations with 21 different configurations. They include: calculation of the fundamental characteristics of a 60° triangular cantilevered wing with and without suspended objects; calculation of the free-state fundamental dynamic characteristics of the combined structure of the above triangular wing, the fuselage, and the horizontal tail; flutter calculation of the above triangular wing without suspended objects; calculation of the fundamental dynamic characteristics of a 40° triangular wing; complete structural calculation of a beam-model consisting of a straight wing, fuselage, tail, and engines, and six modal synthesis calculations; and calculation of the gust response of a B-47 airplane. Satisfactory results were obtained in all the above test cases.

There are plans for further development of the HAJIF-II system. The near-term objectives are: (1) to incorporate additional techniques for non-steady aerodynamic calculations; and (2) to provide the capability for analyzing other types of dynamic responses.

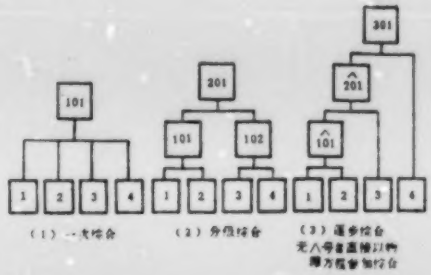

Fig. 1

(1) single-level synthesis
(2) multi-level synthesis
(3) successive synthesis; the blocks without the symbol ∧ represent direct participation in the synthesis using equations of physics

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CABLE TELEVISION PROSPECTS, APPLICATIONS DESCRIBED

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, 1982 pp 2-5

[Article by Yang Jinxiang, [2799 6855 7449], Beijing Municipal Research Institute of Television Technology: "Development and Applications of Municipal Cable Television"]

[Text] With the development of the television broadcasting industry and the rapid increase in the number of users of television sets, the question of effective television reception has become a pressing one. This article provides an introduction to the development and applications of municipal cable television.

Development and Basic Organization of Community Antenna Television Systems

The efficiency of the carrier waves used for wireless transmission of television signals is very high. The VHF band, between 48 and 223 MHz, uses ultrashort waves. These have characteristics similar to light waves; essentially propagating in straight lines and being reflected when they encounter an object. If in their transmission path television waves encounter a mountain or a tall building, they may be blocked, resulting in a "blackout area" where there is no television reception.

Television carrier waves are horizontally polarized. They are spatial waves radiated directly from the transmitting antenna to the receiving antenna. A spatial wave consists of a directly radiated wave and a reflected wave. Because the reflected wave and directly radiated wave take different paths, they differ in phase when they arrive at the receiving antenna. Because cities generally contain large numbers of buildings, not only waves reflected from the ground, but also many waves reflected from buildings arrive at the point of reception, with the result that the field intensity distribution in the vicinity of city buildings is very complex; in some locations the field is strong (about 100 dB), while in others it is weak (below 60 dB). In addition, serious ghost image problems are produced by multipath reflected waves.

City expansion is producing increasing numbers of tall buildings, and inside reinforced concrete buildings the screening effect of the steel

reinforcing rods results in very weak field intensity, in some cases only 40-50 dB, making it impossible to receive television programs, or if they can be received, strong multipath reflected waves produce a serious ghost problem and noise. In addition, interference from industry and various types of electrical equipment also has a serious effect on VHF television reception.

For these reasons, more and more television users have had to erect outdoor television antennas in order to get adequate reception. But if every set has its own antenna, this not only affects the appearance of cities and wastes large quantities of metal and cable, but is also unsafe. In addition, several television sets whose antennas are very close together may interfere with each other as a result of the radiation they produce themselves. The best solution in areas with high concentrations of television sets (such as apartment buildings or closely spaced groups of apartment buildings and the one-story buildings in their "blackout areas") is to set up one or a group of antennas to receive the signals, then use a signal divider network to feed the signal to the individual sets. Many television sets will require only one antenna, and it will be possible to use a cheap, good-performance antenna and to install it in a relatively favorable location. The signal distribution network can be economically wired in terms of the actual locations of television sets in the building, to assure that there is adequate separation between individual sets (generally greater than 25 dB). This method actually groups a number of individual receivers into a collective receiving system; it is called community antenna television (CATV).

Since the first CATV system was erected in the United States in 1949, such systems have made great progress in terms of technology, facilities and range of uses. Table 1 shows the development of CATV in the United States between the early 1950's and the early 1970's. The situation is similar in such countries as England, Japan, West Germany and Canada.

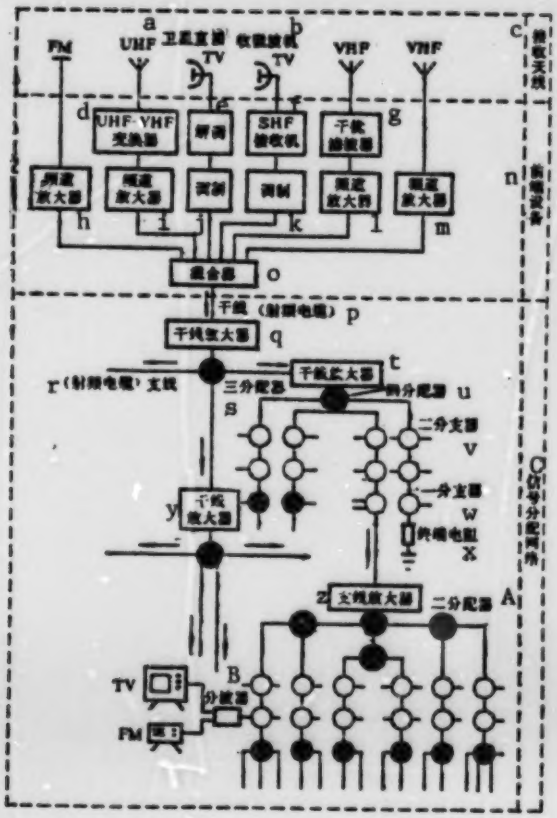
Table 1.

年 b)[a]	CATV设施数[b]	电视机用户数(个)[c]
1952	70	14000
1954	300	65000
1956	450	300000
1958	525	450000
1960	640	650000
1962	800	850000
1964	1200	1085000
1966	1570	1575000
1968	2000	2800000
1970	2350	4500000
1972	2750	6000000

KEY: a. Year
b. Number of CATV installations
c. Number of users

The CATV system consists of a receiving antenna, a head end unit and a signal distribution network, as shown in Fig. 1.

Figure 1.



KEY: a. Direct satellite reception
b. Microwave receiver
c. Receiving antennas
d. UHF-VHF converter
e. Demodulator
f. SHF receiver
g. Interference filter
h. Channel amplifier
i. Channel amplifier
j. Modulator
k. Modulator
l. Channel amplifier
m. Channel amplifier

n. Head end
o. Mixer
p. Trunk (cable)
q. Trunk amplifier
r. Feeder
s. Three-way distributor
t. Trunk amplifier
u. Four-way distributor
v. Two-line tap
w. Single-line tap
x. Terminal resistor
y. Trunk amplifier
z. Feeder amplifier
A. Two-way distributor
B. TV-FM signal separator
C. Signal distribution network

1. The basic task of the receiving antenna and head end unit is to receive the space wave and convert it into an electrical signal, then amplify it to a level which gives the required signal to noise ratio and feed it to the trunk cable.

The selection of an antenna and head end unit should be based on the field intensity and the direction from which the waves are received, the geographic location, environmental conditions, the size of the system, and user requirements.

In a location where the field intensity is high (e.g., greater than 100 db), there is no reflection and several transmitting antennas are located in approximately the same direction relative to the receiving location, when the CATV system is relatively small (e.g. in an ordinary residence), a broad-band antenna for channels 1-12 can be placed in a suitable location on the roof of the building and the signal can be fed directly through the distribution network to the individual sets without amplification. This method not only is economical, but also makes it unnecessary for the users to add new antennas in the future when stations are broadcasting on more frequencies; see Figure 2.

Figure 2

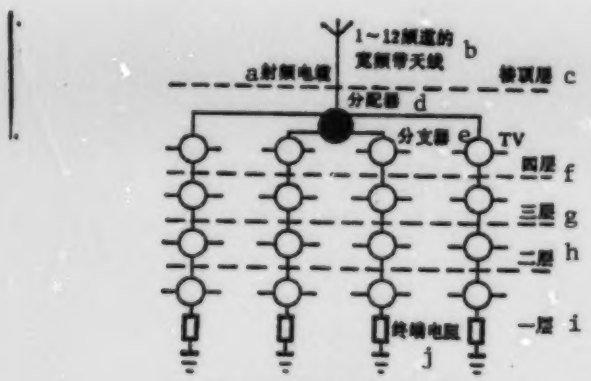


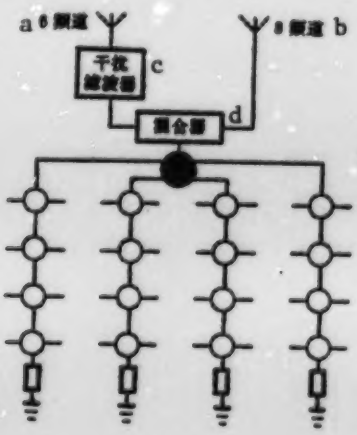
图2 普通居民楼房的CATV系统图

Fig. 2 CATV system for ordinary apartment building

KEY: a. Cable
b. Broad-band antenna for channels 1-12
c. Roof
d. Distributor
e. Distributor
f. Fourth floor
g. Third floor
h. Second floor
i. First floor
j. Terminal resistor

In locations where the field intensity is fairly strong (e.g., greater than 95 db) but reflected waves produce ghosts and interference, highly directional antennas for specific channels which have a high front-to-back ratio must be used. This is because a single-channel antenna has a greater gain than a broadband antenna as well as sharp directionality and a good standing wave ratio, making it possible to overcome ghost production and decrease noise. For special channels it is possible to install a channel filter to decrease interference. If single-channel antennas are used, the best reception point can be selected for each channel. Under these circumstances several antennas are required in order to receive several different programs; their signals are combined in a mixer, then fed to the trunk cable as shown in Fig. 3.

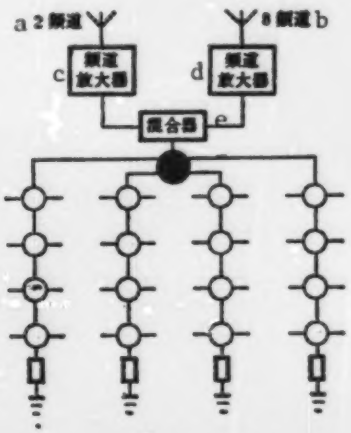
Figure 3



KEY: a. Channel 6
b. Channel 8
c. Interference filter
d. Mixer

In areas where the field intensity is relatively weak (generally less than 60-70 dB) and there is a relatively large amount of interference, in order to assure a sufficient signal to noise ratio the signal from the antenna must be amplified to a suitable level before feeding it the cable. Under most conditions there will be considerable differences between the signal strengths of different channels received in the same location, and in order to enable the television sets to receive largely equivalent signals from all of these channels it is best to provide an individual channel amplifier for each signal before the mixer, as shown in Fig 4. By adjusting the gains of these amplifiers, the signals can be fed to the mixer at equal strength. Because the channel amplifier acts both as an amplifier and as a filter, image quality is relatively good.

Figure 4.



KEY: a. Channel 2
b. Channel 8
c. Channel amplifier
d. Channel amplifier
e. Mixer

Because cable loss is proportional to the square root of frequency, when receiving ultrahigh frequency (UHF) signals a frequency converter is generally installed in the head end unit to convert the UHF signal to a VHF signal, which is then distributed to the users. If the head end of a CATV system also is provided with some type of microwave converter equipment and superhigh-frequency converter equipment, all of the television users in the system can receive microwave cable and satellite television transmissions directly. In addition, large CATV systems head ends also have a pilot signal generator which provides the control signals required for automatic gain control and automatic tilt control in the trunk amplifiers of the signal distribution network.

2. The task of the signal distribution network is to distribute a television signal of the requisite quality to the individual sets. It

includes trunk cable amplifiers, distributors, feeder amplifiers, taps, matching elements, and in some cases TV-FM signal separators.

After the signal has been fed to the trunk cable, it is amplified by the trunk amplifier to make up for trunk cable losses and restore signal quality to the previous level, after which the signal is distributed at equal power to several feeder cables by a distributor; a tap draws off some of the signal power from the feeder cable and sends it to the matching elements via a branch feeder cable, from which it is transmitted to the individual television sets. If the CATV system also includes FM reception, the drop cable transmits the signal to a signal divider, which separates the television and FM signals, after which they are sent to separate matching elements and from there to the individual television and radio sets. If the cable attenuation after the tap is large, a tap amplifier can be added; see Fig. 1.

The Development of Closed Circuit Television

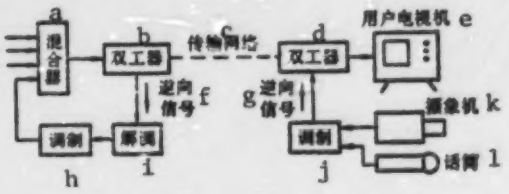
The CATV system was originally developed to solve television reception problems, but after a perfected signal distribution network was used to provide reception to several television sets, it could carry not only television signals broadcast through the air, but also locally produced television signals; provided there was a program production capability it could constitute a complete closed circuit television system (CCTV). A CCTV system generally consists of a head end unit and video recorders, video disk players, TV film units and the like, and may even be provided with a complete small set of small-scale studio equipment. This greatly enriches the content of television programs. According to statistics, in 1973 more than 50 percent of all CCTV systems in the United States could do their own broadcasting. Independent broadcasting on these systems was generally of two types: the first included videotaped programs, movies, and educational and local news programs, all of which were produced within the system; the other type used automatic broadcast equipment which automatically broadcast weather reports, standard time, music, commercial advertisements and the like at fixed intervals. Once CCTV systems of this type are established, their applications value obviously greatly exceeds that of broadcast television, and non-broadcast television is developing rapidly on a large scale within the CCTV industry.

Development of Two-Way Closed Circuit Television Systems

In order to expand the capabilities of CCTV systems, such countries as the United States, England, Japan and Canada are actively developing two-way closed circuit systems in which transmission can be conducted in both directions simultaneously. As early as 1970, two-way CCTV systems which could be used for fire warning, burglar alarms and information and could transmit simple reply signals were displayed at a conference of the United States National Cable Television Society.

The basic operating principle of CCTV is shown in Fig. 5.

Figure 5. Block diagram of two-way cable television system



KEY:
a. Mixer
b. Duplexer
c. Transmission network
d. Duplexer
e. User television set
f. Upstream signal
g. Upstream signal
h. Modulator
i. Demodulator
j. Modulator
k. Camera
1. Microphone

A band below the first television channel (30-45 MHz) and a band between the FM band and VHF television channel No 6 (120-160mMHz) are generally reserved as the upstream (from the user to the head end unit). TV signal transmission bands. The video signal put out by the user's camera and the audio signal put out by the microphone are used to modulate the 30-40 MHz or 120-160 MHz carrier, and the high frequency all-television signal form is fed into the transmission trunk to the head end unit. A demodulator in the head end unit reconstitutes the audio and video signals from the user, then uses them to modulate the required frequency channel and transmits it to another user. In this way users can exchange programs they have produced themselves.

Two-way closed circuit television is used extensively in television in ruction. If a broadcast control center is added to the head end shown in Fig. 5, the lecture given by a teacher in the broadcast control center is recorded by camera and microphone, then sent via the modulator to a mixer for transmission to classrooms; similarly, the classroom camera and microphone are used to transmit the class situation back to the control center, using a duplexer. Medical school surgical demonstrations can be transmitted to the broadcast control center as control signals, then rebroadcast to other classroosm. In addition, special signal generators located in the classroom can be used to send control signals to the control center for automatic operation of video recorders. The technological quality of two-way closed circuit television can be improved; not only will it be

possible for individual users to exchange television programs, but the content of the programs has already gone beyond that of broadcast television. Two-way closed circuit television has gradually developed into a combination of television, broadcast, telephone, data and other information exchange.

Optical Cable Systems

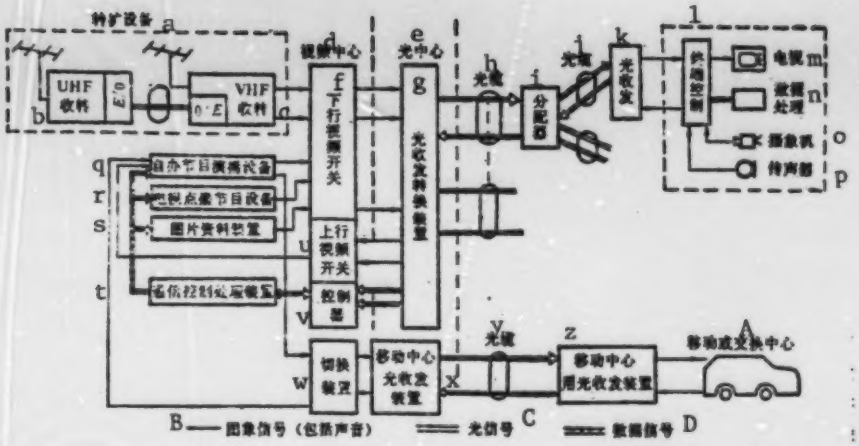
The scale of closed circuit television is steadily increasing, the lines are gradually becoming longer, more and more signals are being transmitted, and the weak points of electrical cable as a transmission medium are becoming increasingly apparent. The characteristics of optical cables are increasingly attracting favorable attention. Currently optical cable transmission losses are much smaller than those for electrical cables, their costs have decreased to the point where they are competitive with electrical cables, and the components and parts of optical transmission lines are steadily improving, so that optical cable systems are beginning to enter the application stage.

Since 1974, such countries as the United States, England and Japan have applied optical fiber transmission theory to CATV systems and have organized optical cable transmission networks, thus overcoming the problems resulting from the large size of cable used in two-way closed circuit television and CATV networks, so that people can select television broadcast programs from a range of locations at will.

CATV systems can be used extensively in television education, clinical consultations, technical experience exchange, industrial management, facsimile transmission, commercial information and the like, creating the "wired city," and realizing the dreams of mankind.

For example, in 1978 a "optical fiber wired city" was begun in Higashi-ikoma near Osaka, Japan; it replaces coaxial cable with optical cable and features two-way service systems. The system is shown in Fig. 6. The program exchange center has news, cultural programs (including color television, stereo sound broadcasting, and image date); the communications control and processing equipment includes TV, telephone, telemetry, emergency reporting, computer controlled instruction and the like.

Figure 6.



KEY:
a. Conversion equipment
b. UHF receiver-converter
c. VHF receiver-converter
d. Video signal center
e. Optical center
f. Downstream video switching
g. Optical transducer-converter
h. Optical cable
i. Distributor
j. Optical cable
k. Optical receiver
l. Terminal control
m. Television
n. Data processing
o. Camera
p. Sound pickup
q. Studio equipment
r. Remote
s. Graphic data equipment
t. Signal control and processing equipment
u. Upstream video switching
v. Controller
w. Switching unit
x. Mobile center optical transducer equipment
y. Optical cable
z. Mobile center's optical transducer
A. Mobile or exchange center
B. Facsimile signal (including audio)
C. Optical signal
D. Data signal

In addition, independent cables installed in major assembly places, theaters, schools and hospitals, and when necessary a mobile exchange center (rebroadcast truck), can be used for temporary transmission of special programs.

Conclusion.

Our country's CATV systems have already entered the application stage. Many hotels, restaurants, schools and new multistory buildings in Beijing are equipped with such systems, and development is gradually proceeding from simple CATV systems to closed circuit TV systems. Relevant units are pursuing serious research and are preparing to draft CATV standards for our country. The situation is a gratifying one. Development and practical work on optical systems has also made much progress. If further large scale planning can be conducted, prospects for development are extremely great. The development and applications of cable television will be sure to make a contribution to our country's four modernizations.

8480
CSO: 4008/121

TRANSONIC AXIAL COMPRESSOR TEST RIG DESIGNED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 11, 1981 pp 2-4

[Article by Fang Jianshan [2455 6015 1472]: "Experimental Transonic Axial Compressor"]

[Text] The axial compressor is a key component of the turbojet engine in modern aviation. To improve the performance of the compressor, we must study the very complex ternary flow involving viscosity, shock wave and secondary flow. It is difficult to deal with many of the phenomena and problems in such a complex flow process completely by theoretical analysis. Even if we used the presently developing theory of ternary flow to design the compressor, it would have to be done on the assumption of a previously given loss distribution. But a rational assumption can only be made by carefully measuring and analyzing in detail the internal flow field of the compressor and only after fully understanding the patterns of such flow.

For this purpose, the Thermophysics Institute of the Chinese Academy of Sciences designed and built a transonic single and double stage axial compressor testing rig in order to conduct basic experimental research (see Figure 1). The equipment consists of an intake and exhaust system, a power generator and a transmission system, a lubricating and cooling system, a measurement and data gathering and processing system and an operating and control system.

When the experimental unit is in operation, air is sucked in and passes through the intake muffler tower, a double layer filter mesh, and enters the air intake chamber separated from the experimental housing. The air exhausted from the experimental compressor is collected by an exhaust collector and channelled into underground tunnels. Then it passes through the exhaust muffler tower and is released into the atmosphere. This new whole body design not only prevents the mixing of air currents flowing from the experimental housing to the flow measuring devices at their intake point, thus causing the flow measurements to be inaccurate, but it also improves the rate of utilization of the experimental housing and is beneficial to noise elimination and soundproof design of the whole facility.

The following is a brief introduction to the major components of the experimental facility and their characteristics.

Figure 1. Experimental Platform of the Transonic Axial Compressor

I. The Power Generator, the Transmission System and the Lubricating and Cooling System

The power source rebuilt from an airplane engine is simple to operate, but the problem of environmental pollution is difficult to solve. In particular, the steady speed precision generally reaches only 0.2 percent, and this is unfavorable to improving the precision of the whole experiment.

This experimental unit uses a ZD180/31.5 high-velocity direct-current electric motor as the power source. The specified capacity is 3,000 kilowatts. The highest designed speed of rotation is 750 revolutions/minute. Its operating range is wide. Its overload capability is high. It has a broad and smooth velocity governing characteristic, and automated operation and control is easy to realize. The operating characteristic curve of the electric motor and the range of the parameters of the experimental compressor being driven by motor are shown in Figure 2. The experimental compressor is driven by a controllable silicon transmission device of a precise velocity governing system of 3,000 kilowatts especially developed for this purpose to improve the precision of steady speeds. Alternating current of 10,000 volts passes through two rectifier-transformers to lower the voltage. Then the current is rectified in 12 phases through 4 three-phase fully controlled rectification bridges to become a direct current. Then it is fed to the armature winding. By changing the silicon-controlled lead-pass angle, we can change the voltage at the electric motor terminal to realize adjustments and stabilize the speed of rotation (we can also use the weak magnet operating system of the controllable silicon-controlling device for speeds over 550 revolutions/minute). The entire control process is digital, i.e., digitally given (speed of rotation), (speed of rotation) digital feedback and digital display. The signal of the given speed of rotation are mathematically calculated by subtraction in the full subtracter. The difference is converted, adjusted and fed to the trigger

circuit to generate the trigger control signal which changes the silicon-controlled lead-pass angle. The circuit also eliminates the static error of the system by utilizing the error integration channel to eliminate residual deviation and thus realize error-free velocity control.

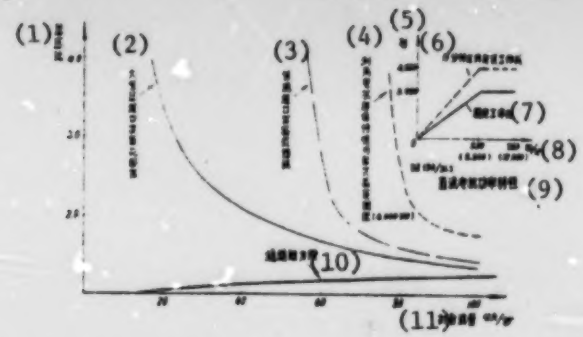


Figure 2. Power Characteristics of the Electric Motor and the Range of Parameters of the Experimental Compressor

Key:
(1) Total pressure ratio
(2) Limitation of the experimental range of barometric pressures at entry
(3) Limitation of the experimental range of throttle entry
(4) Limitation of the possible experimental range utilizing overload characteristics of the electric motor
(5) Kilowatts
(6) 15-minute allowed overload operating line
(7) Specified operating line
(8) Revolutions/minute
(9) Power characteristics of the direct-current electric motor
(10) Channel resistance limit
(11) Converted to amount of flow, kilograms/second

The feedback signal of the speed of rotation needed by the governor system must be accurate and reliable. If the signal is discontinued, the experimental device will lose control, exceed its speed limit and even break down. For this, we have designed a dual circuit rotational speed pulse generator. Electromagnetic and photoelectric rotational speed pulses serve as each other's reserve. When one circuit malfunctions during operation, the other circuit automatically begins operation.

The silicon-controlled element is cooled by the de-ionized cooling water supplied by the pure water supplier, while the electric motor is cooled by a closed-circulation fan cooling system.

The results of test runs show that the transonic compressor driven by the above power generator can rapidly and conveniently change its speed of rotation. The steady state and steady speed precision is better than 0.03 percent, reaching the internationally advanced level of similar compressor testing equipment.

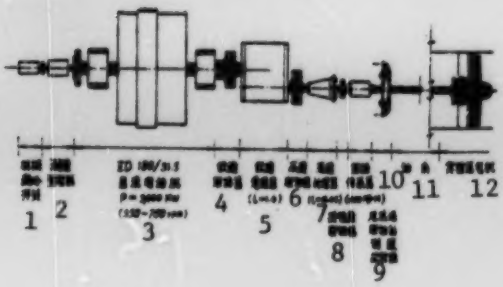


Figure 3. Illustrative Diagram of the Transmission System

Key:

(1) Mechanical centrifugal switch
(2) Velocimeter generator
(3) ZD180/31.5 direct-current electric motor
(4) Low-speed shaft joint
(5) Low-velocity speeder
(6) High-seed shaft joint
(7) High-velocity shift
(8) Flexible disk shaft joint
(9) Torque sensor
(10) Nylon cord shaft joint velocimeter gear disk
(11) Axile shaft system
(12) Experimental compressor

Figure 3 illustrates the transmission system. The output of the 3,000 kilowatt direct-current electric motor can reach a maximum rotational speed of 12,000 revolutions/minute (or 15,000 revolutions/minute) after being speeded up by a low-velocity gear speeder with a speeding ratio of i = 1.4 (or 1.74) and a planetary high-velocity gear speeder with a ratio of i = 11.45. The output axile of the high-velocity speeder drives the experimental compressor via the torque sensor which drives the transmission shaft system. The standard calibration for adjustment and installation of the transmission system is selected as a low-velocity speeder to reduce cumulative deviation from nonconcentricity. The radial and axial nonconcentricities of the electric motor and the low- and high-velocity gear speeders are adjusted to $\leq$0.02 millimeters. Consideration is also given to the thickness of the oil film on the sliding bearings during operation, so allowance for nonconcentricity was preset during stationary readjustment.

Nylon pin elastic shaft joints are used to connect the electric motor and the low-velocity speeder as well as the low-velocity and high-velocity speeders. The shaft joints do not transmit axial force and they have a definite flexibility, suitable for transmission equipment of large power and low speeds of rotation.

To insure normal operation of the torque sensor, the method of connecting it to the high-velocity speeder and the transmission shaft system must be carefully selected. This experimental device uses elastic disk shaft joints of equal thickness between the torque sensor and the high-velocity speeder. At the time of installation, we first made sure that their concentricity requirements were satisfied. We designed a nylon cord shaft joint (see Figure 3) suitable for large power and high rotational speeds between the torque sensor

and the transmission shaft system. The difference between the nylon cord shaft joint and ordinary shaft joints is that when we designed and installed the shaft joint, we made sure that the driving disk and the driven disk were in the same axial plane as much as possible, thus basically eliminating axial forces. Experience of operation shows that as long as the radial nonconcentricity is $\leq$0.2 millimeters, it can operate normally. Compared to other joining methods, our joint is easy to make and install, and it has greater flexibility. It is a rather new and effective way of joining. On the driven disk of the shaft joint are 90 stepped teeth distributed evenly on the circumference to serve concurrently as the velocimeter disk to produce feedback pulse signals which indicate the speed of rotation.

The various rotating parts of the transmission system are divided into low-speed and high-speed components. They are separately lubricated by two sets of integrated XYA-125 model oil thinning stations using lubricating oils of different densities. To improve the ability of the high-velocity gear speeder to recirculate the oil, we installed another special RCB-50 gear oil pump. We also improved the emergency high-level oil tank and made it into a pressurized oil storage tank and improved its reliability for emergency oil supply.

II. Intake and Exhaust System

During experiments with the compressor, it produced strong, loud noise. Therefore similar intake and exhaust muffler towers were built. Their structure is shown in Figure 4. The wall of the tower is a solid core brick wall of variable thickness. The surface of the bottom of the intake air tower is covered with sound-absorbing materials. Total sound insulation can reach 50 to 60 decibels, so the design of the muffler is the key to controlling noise.

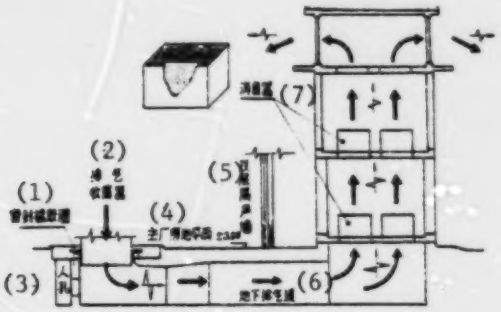


Figure 4. Illustrative Diagram of the Exhaust Channel and the Exhaust Muffler Tower

Key:

(1) Rubber sealing ring
(2) Exhaust air collector
(3) Manhole
(4) Ground surface of the main building
(5) Double layer sound insulating wall
(6) Underground exhaust tunnel
(7) Muffler

During the experiment with the compressor, the main source of noise is that due to rotation, the noise from vortex flow, and the jetting noise of the intake and the exhaust. The former two types of noise are of medium and high frequencies, and the latter type is of relatively low frequency. These three, especially the first frequency spectrum, are closely related to the compressor and its operation. Therefore, the design of the muffler is aimed at muffling noise of wide band continuous spectra. The total noise reduction by the rejection type muffler of two-section perforated plates which we designed is 30 decibels. The channel-to-area ratio of the component is 1:1. Without the rejection reducing heads at the two ends, the actual muffler element is 0.9 meter long. The perforation rate of a 1-millimeter-thick steel plate is about 4 percent. The inside is filled with ultrafine glass wool wrapped in glass fiber. The actually measured noise reduction reached the designed requirements.

The results of our sound insulation designs to muffle the noise of intake and exhaust of the entire laboratory and our designs to insulate sound in the building structure are satisfactory. The results of experiments conducted late at night showed that when the noise inside the housing reached nearly 120 decibels (A level sound), the A level noise in the residential area only a dozen meters away from the laboratory was only 51 decibels.

We know from Figure 2 that the lower limit of the allowable operating range of the experimental compressor is determined by loss due to resistance in the air duct of the intake and exhaust system. Therefore, we have included in the facility many measures to reduce flow resistance:

Larger dimensions for the intake and exhaust air ducts were used to reduce flow resistance. This also provides leeway for possible increases in the capacity of the power source.

The present intake air filter is a fine copper mesh with a layer of foam plastic 5 millimeters thick. The filter is laid flat. The results of air purification are good. We plan to change the flat mesh to a removable board to reduce flow resistance.

We lengthened the pressure expansion segment to reduce expansion loss when the air current enters the pressure stabilizer box.

The outer diameter of the box channel of the exhaust pump has been made larger (1,250 millimeters), and the axial length is taken as 1,250 millimeters. In this way, not only can we design the compressor with higher parameters by enlarging the diameter for testing, but we can also better arrange the pressure expansion channel to reduce loss. This is better for studying the single rotor compressor.

The area of the underground tunnel between the exhaust air collector and the exhaust muffler tower has been gradually expanded to reduce any increase in flow resistance brought about by each turn the air current makes in its path of flow.

The above measures were shown to be effective in actual measurements during test runs.

Besides the above characteristics, the eight blades of the exhaust throttle valves of the compressor were installed inside the eight fan-shaped channels of the frontal box of the air exhaust. This was done in an attempt to place the exhaust throttle valve relatively close to the compressor in the experimental setup of the axial compressor. This may be beneficial to controlling the operating state of the air compressor because of a reduced exhaust volume. Whether this is so and what effects this setup has on the operating characteristics of the experimental air compressor will have to be comparatively studied by experimentation.

III. Measurements and Data Collection, the Processing System, and the Operating and Control System

Measured data are the basis for analyzing the internal flow field of the compressor. Therefore, the compressor must be equipped with an advanced system of meters. According to possible conditions, we plan to set up such a system and perfect it in stages.

Pressure measurements use many pressure sensors to improve the speed of measurement. To improve the precision of measurement, besides introducing some high-precision sensors, the domestically manufactured sensors with a low precision have been carefully analyzed and calibrated. We have used computer technology to correct various types of errors so that the error of pressure measurements was kept within ±3 millimeters of the water column.

A copper resistor thermometer is used to measure the total average temperature of the air current inside the intake chamber. The sensitized element consists of copper mesh laid flat over a large area and placed on top of the first dust screen. The measurement of the temperature of the air current inside the compressor uses a copper-constantan thermoelectric coupler.

Measurement of the torque and the speed of rotation is carried out within a working range of 0 to 400 kilograms·meter and uses a 0 to 12,000 revolutions/minute phase-type rotary torque and rotary speed velocimter. The error found by stationary checks of the torque sensor at loading and unloading was ±0.1 kilograms·meter. The zero drift error at the time of load-free readjustment of the meters was within ±0.15 percent.

The data gathering system and processing system currently used convert pressure signals from various channels into electrical signals via the pressure sensor. Then, the electrical signals are fed together with the electrical signals of other parameters into the Solartron 200 dot itinerant detector. The data gathered are recorded on punched cards or fed to a Wang-2200 PCS-II small computer. The data are revised, recorded and analytically calculated by a precompiled program. The control console gives and displays the speed of rotation of the experimental compressor and automatically maintains the speed, changes the speed of rotation, changes the operating condition of the experimental compressor by regulating the opening of the intake and exhaust air throttle valves, and displays data of important monitoring positions of the

various systems which have entered into relay protection series. The data gathering and processing systems will send parameters of the main operating states of the experimental compressor such as converted flow, converted speed of rotation and pressure ratio to the control console for real-time display. The control console also has a multiplex multiple function intercom so that the operator can maintain contact with related positions and record command procedures during the experiment.

The central control room also has equipment and secondary meters to monitor vibration of the equipment, stress of the blades, and radial gaps of the rotor.

To improve the speed of data gathering and processing and to realize a high degree of automation of the experimental procedures, we will soon import an American HP-1000F computer and a HP-3054A data gathering system.

This experimental setup will also use the L2F4000 laser dual-focal-point velocimeter manufacted by West Germany's Polytec Company to measure the inner velocity field of the rotor channel. This velocimeter was designed especially for testing vane wheel machinery. It can trace the rotation of vane wheels and carry out continuous automatic measurement of as many as 32 measuring points between two blades. It uses a combination of several microprocessors to control and manage the laser and the data processor. The precision of velocity measurements is better than 1 percent and the directional precision is better than 0.5°. The phase shift mechanism driven by the stepping motor can rapidly and accurately change the position of the axial and radial measuring points. The optical window on the casing of the machinery allows cleaning of the parts during the course of the experiment to assure reliable measurements. Its operating and control console is situated in the central control room.

The transonic single and double stage axial compressor testing facility built by the Engineering Thermophysics Institute was evaluated jointly by the Chinese Academy of Sciences and the First Ministry of Machine Building in June 1981. It will be a forceful tool in basic experimental research in transonic compressors. It will serve in exploring the pattern of internal flow of compressors and in developing the ternary flow theory of vane wheel machinery.

9296
CSO: 4008/95

AUTHOR: CHEN Teluan [7115 3676 7019]

ORG: South China Institute of Technology

TITLE: "Simulation of Combustion Process of the Medium Speed Diesel Engine"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 1-9

TEXT OF ENGLISH ABSTRACT: This article is a part of the author's research work done at Trondheim University, Norway. It describes a simulating model of the combustion process of the medium speed diesel engines based on the monosized droplet combustion theory to predict the variations of gas pressure, temperature and heat release rates. Comparing the calculating results with the measured data from a couple of medium speed diesel engines, we find that the results obtained from the model are quite accurate, quick and simple, and can be considered as a starting foundation for further research.

AUTHOR: ZHU Shilu [2612 1102 6922]
NI Hanning [0242 3352 1380]

ORG: ZHU of Shanghai Jiaotong University; NI of Henan Diesel Works

TITLE: "Effect of the Inlet Flow Distortion in a Centrifugal Compressor on the Crack of Inducer Blades"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 10-19

TEXT OF ENGLISH ABSTRACT: This paper deals with the exciting source of vibration which leads to crack the inducer blades of a turbocharger. The described testing method and results concerning this problem show that at the outlet section of the inlet port there is a circumferential total pressure distortion which is the exciting source of vibration that leads the resonating inducer blades to crack. A secondary flow model is proposed to explain the cause of the formation of that distortion. Several kinds of inlet port, including some vortex generators, have been tested in order to reduce the distortion. Through these experiments an improved inlet port design which can cut down the amplitude of distortion to 13.2 percent of its original value has been found.

AUTHOR: DONG Yaoqing [5516 2556 3237]
NI Baofen [0242 5508 5364]
SHE Fenying [0152 5358 5391]

ORG: All of the Dalian Diesel Locomotive Research Institute

TITLE: "The Design and Research Work on Increasing the Fatigue Life of the Fuel Injection Pump Cam for High Rated Diesel Engines"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 20-27

TEXT OF ENGLISH ABSTRACT: This article deals with the fatigue life of the fuel injection pump cam for high rated diesel engines by means of the classical Hertz theory together with the newly developed elastohydrodynamic theory. Studying the effects of some designing and operating parameters on Hertz pressure and oil film thickness, it points out that the increment of the equivalent radius of the cam curvature as large as possible is very significant to the decrement of its fatigue. Therefore, a fuel injection pump cam with a high fatigue life can be computer-aided design under the consideration of secondary injection, cavitation and reliability of the fuel injection system and the performance of the engine as well.

AUTHOR: CHEN Boxian [7115 0130 6343]

ORG: Shanghai Internal Combustion Engine Research Institute

TITLE: "The Design Calculation and Improvement of Thin-walled Bearing Shells"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 28-36

TEXT OF ENGLISH ABSTRACT: At the present, the result of the analysis of elastic theory in interference fit between two circular tubes of infinite length is still used in designing thin-walled bearing shells. However, as the ratio of thickness to diameter of bearing shells gets smaller, it becomes rougher for bearing shells and design and for its ineffectiveness analysis. This paper presents the equations to calculate the stresses and strains of the bearing shell treated as a thin-walled elastic composite curved plate under frictional force. These equations may be used as a foundation for design calculation and ineffective phenomena analysis of the bearing shells.

AUTHOR: WANG Ziyan [3769 1311 1693]
JIANG Deming [5592 1795 2494]

ORG: Both of Xi'an Jiaotong University

TITLE: "The Tensiometric Microprobe for Unsteady Flow Velocity Measurement and Its Applications to the Internal Combustion Engine"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 43-51

TEXT OF ENGLISH ABSTRACT: This paper describes the experience of development in the tensiometric microprobe with a dynamic pressure pick-up sheet for unsteady flow velocity measurement and gives the experimental results of the air flow velocity in the intake manifold and the velocity distribution in the swirl combustion chamber of a motored single-cylinder diesel engine with bore and stroke of 95 and 115 mm respectively.

9717
CSO: 4009/292

AUTHOR: MA Yunjie [7456 0061 2638]

ORG: None

TITLE: "The XZ-1 Type UHF Selector"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: Shanghai Radio Plant No 18 has successfully made the Feiyao Brand XZ-1 model UHF selector. It has been produced in batches and placed in the market for sale. The selector is composed of the 2 parts of a boxed unit and a loop antenna. In the unit, there is an independent stable voltage power source. It has 13-48 operating channels and can convert UHF signal frequencies into the frequency of the VHF channel No 12; therefore, it can extend the reception of various types of television sets of 1-12 VHF channels to include the 13-48 UHF channels. The selector should be placed in the front or side of the television set and be plugged into the external antenna receptor. The loop antenna may be rotated to adjust the direction of the selector in order to obtain clear pictures and pleasing sound.

AUTHOR: MA Yunjie [7456 0061 2638]

ORG: None

TITLE: "The CS-2 Digital Fathometer"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: Shanghai Ultrasonic Wave Instrument Plant has successfully made a new type digital depth-sounder for boat use. After technical certification and test application for several thousand km of navigation by Dongfanghong Ships No 403 and 404, the instrument has been proved to have reliable properties. The display is clear, the operation is convenient, and it is useful for promoting safe navigation. Chinese made medium scale integrated circuitry and transistors are used in the instrument. Compared with the old fathometers, it is smaller, lighter, more sensitive, and it consumes less power and has an automatic warning system. It is designed for use in inland rivers, deep lakes, and the coastal sea for measuring the water level.

AUTHOR: LIN Fu [2651 2105]

ORG: None

TITLE: "China's First 480-Path Pulse Code Modulation Multiplex Equipment"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: Not long ago, the Research Institute of Laser Communications, Wuhan Academy of Sciences, the Ministry of Post and Telecommunications successfully made the 480-path (34 Mb/s) pulse code modulation multiplex equipment, which is the major component of the digital communication series equipment. It may be used as the terminal in optical communication, microwave communication, coaxial cable, etc. digital transmission systems. It may be divided into the 4 parts of the dispatcher (multiplexor,) the receiving part (the separate connector,) the monitor shared by the dispatcher and the receiver (alarm system) and the power source. The various electrical properties have been found to meet the related regulations of the CCITT and its stucture has been found to be reasonable.

AUTHOR: ZHENG Yaolin [6774 5069 2651]
HOU Jiayin [0186 0857 7113]

ORG: None

TITLE: "Shaanxi Color Kinescope Plant Has Begun to Supply Domestic Television Plant With Qualified Picture Tubes"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: After 2 years and 8 months of intense work, Shaanxi Color Kinescope Plant has produced the first batch color picture tubes on 14 Oct 81. Small scale production of the picture tube began in late Dec for supplying the 21 television plants in Beijing, Shanghai, Tianjin, Sichuan, Zhejiang, Jiangsu, Fujian, and Shaanxi. The quality of the picture has been certified to be at the advanced level of similar products of Japanese plants. According to the plan, by October this year, the picture tubes will be produced in large quantities, i.e. 960 thousand 14-inch and 22-inch color picture tubes a year, to guarantee the needs for assembling color television sets of the entire country. There will be no need to import color picture tubes any more.

6248
CSO: 4009/290

AUTHOR: YU Xiaoqin [0205 5135 3830]

ORG: None

TITLE: "The Editorial Committee of YEYA YU QIDONG Held an Expanded Conference in Shanghai"

SOURCE: Beijing YEYA YU QIDONG [HYDRAULICS AND PNEUMATICS] in Chinese No 1, 15 Mar 82 p 60

ABSTRACT: The Editorial Committee of the journal held an expanded standing committee conference in Shanghai on 1-4 Dec 81. Participants included the members of the standing committee of the editorial committee and those members of the editorial committee who were in Shanghai. There were a total of 17 persons attending. The work of the editorial department in 1981 was reported and examined and measures for improving the editorial work and the quality of the journal were suggested. The policies and goals of the journal were reviewed and the essentials to be reported in 1982 were checked. The participants all affirmed the achievement of the editorial department in 1981 while, at the same time, proposed some concrete measures to improve the quality of the journal as well as the editorial work. In 1982, the contents proposed by the All Member Conference of the Editorial Committee will remain the essentials while at the same time activities of the Chinese Agricultural Machinery Society, the Chinese Mechanical Engineering Society Hydraulics and Pneumatics Specialty Committee,and the National Hydraulic and Pneumatic Standardiza-

[continuation of YEYA YU QIDONG No 1, 1982 p 60]

tion Technological Committee and papers concerning standardization, hydraulic movement machines, hydraulic and pneumatic equipment used in departments of light industries and textiles, etc. and self-designed products will also be presented. In a very uplifted spirit, all participants resolved to continue to contribute to improving the quality of the journal and to promoting continuous development of hydraulic and pneumatic technology of China.

AUTHOR: XUE Nong [1331 6593]

ORG: None

TITLE: "First Successful Use of Cone Valve Type Hydraulic Integrated System in Large Arc Furnace"

SOURCE: Beijing YEYA YU QIDONG [HYDRAULICS AND PNEUMATICS] in Chinese No 1, 15 Mar 82 p 64

ABSTRACT: The cone valve (insert valve, logic valve) is a new hydraulic control component. In foreign countries, it was developed in the 70's and has been applied in forging press, plastics machines, etc. In 1980, a cone valve integrated system was developed for the 2 electric arc furnaces of Shangang X Plant, a steel mill. The system was jointly designed by Shanghai Academy of Metallurgical Design, Shangang X Plant, and Beijing Metallurgical Hydraulics Machinery Plant. The arc furnace was manufactured by Xian Electrical Furnace Plant. Most recently, the system was further improved. It will soon undergo certification by the state before this new technology can be extended to improve the technical level of China's metallurgical equipment.

6248
CSO: 4009/291

AUTHOR: ZHENG Diji [6774 5530 1015]
FU Chongyue [0265 1504 6141]

ORG: Both of the Department of Nonferrous Metallurgy

TITLE: "Equilibrium Study on the Lead-Chloride Ion-water System at High Ionic Strength and Elevated Temperatures"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 1-9

TEXT OF ENGLISH ABSTRACT: According to the method proposed in the authors' previous works and the equilibrium constants of the complex formation reactions measured by one of the authors, equilibria in the lead-chlorid ion-water system at high ionic strength (I=5) and elevated temperatures (25~75°C) have been studied. In particular, the E-log[Cl^-] diagram and the derived solubility curves of lead chloride as well as its characteristics during the crystallization on cooling are analyzed and discussed in detail, with a series of useful expressions being deduced.

AUTHOR: ZHENG Diji [6774 5530 1015]

ORG: Department of Nonferrous Metallurgy

TITLE: "Equilibrium Constants for the Formation Reactions of Lead (II)-Chloro Complexes"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 10-15

TEXT OF ENGLISH ABSTRACT: In order to provide fundamental data for the thermodynamic analysis of reaction systems involved in hydrometallurgy of lead, equilibrium constants for the formation reactions of lead (II)-chloro complexes at high ionic strength (I=5) and elevated temperatures have been determined by using potentiometric methods. The values of equilibrium constants at different temperatures are as follows: $K_1 = 10^{1.28}$, $K_2 = 10^{1.75}$, $K_3 = 10^{2.12}$, $K_4 = 10^{1.5}$, at 25°C; $K_1 = 10^{1.44}$, $K_2 = 10^{1.91}$, $K_3 = 10^{2.26}$, $K_4 = 10^{1.65}$, at 50°C; $K_1 = 10^{1.56}$, $K_2 = 10^{2.04}$, $K_3 = 10^{2.38}$, $K_4 = 10^{1.85}$, $K_5 = 10^{1.24}$, at 75°C.

AUTHOR: MEI Guanggui [2734 0342 6311]
ZHONG Zhuqian [6945 4554 0467]

ORG: Both of the Department of Nonferrous Metallurgy

TITLE: "Theoretical Analysis of Process of Zinc Calcine Hot Acid Leach"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 16-23

TEXT OF ENGLISH ABSTRACT: The potential pH diagrams for magnetite-water and zinc ferrite-water systems at 25°C and 100°C have been constructed, by which we can explain thermodynamically the experimental result of zinc calcine hot acid leach, i.e., high temperature (1100°C) zinc calcine is much easier to leach than ordinary zinc calcine. The kinetic factors influencing zince ferrite acid dissolution are also analyzed. In addition, the capacities of acid addition for Goethite and Jarosite processes are interpreted.

AUTHOR: YANG Chongyu [2799 6850 1946]
LONG Yuanzhi [7893 6678 1807]
CHEN Qiande [7115 6197 1795]
TANG Xiangqi [0781 0686 3825]

ORG: All of the Department of Nonferrous Metallurgy

TITLE: "Preliminary Investigation of the Digestibility of Pingguo Bauxite"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 24-30

TEXT OF ENGLISH ABSTRACT: Pingguo bauxite is a kind of diasporic ore. It contains high iron oxide, most of which is present as geothite. Some influencing factors on the extraction of aluminum oxide from Pingguo bauxite were investigated. In order to compare the digestibility of Pingguo bauxite with that of some other main domestic deposits, digestion tests were carried out under the same conditions. The characteristics of these ores were also studied by X-ray diffraction, differential thermal analysis and infrared spectroscopy. Some samples of red mud were observed with electron microscopy. In the present paper the experimental test results and the main conclusions are given. The digestibility of Pingguo bauxite, the behavior of its geothite during digestion as well as the effects of CaO, $NaSO_4$ and NaCl as additions to the digestion liquor are also discussed.

AUTHOR: PENG Rongqiu [1756 1369 4428]
CAI Chuansuan [5591 0278 4615]

ORG: Both of the Department of Nonferrous Metallurgy

TITLE: "Treatment of Complex Sulfide Concentrate Containing Copper, Zinc and Lead"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 31-37

TEXT OF ENGLISH ABSTRACT: All tests were made with flotation complex sulfide concentrate having the following analysis in wt-pct: 14.57 Cu, 16.52 Zn, 9.52 Pb. The roasting of this concentrate was conducted in a fluidized bed roaster with a bed area of 0.2 M^2. Experimental results showed that the minimum superficial gas velocity for normal fluidization was more than 1.1 $m.s^{-1}$ at 800°C. Based on this experimental data the equilibrium gas composition for oxidizing and sulfatizing roasting of this concentrate was calculated. The principal flowsheet of hydrometallurgy and direct smelting for treating this complex sulfide concentrate was also proposed.

AUTHOR: TONG Ziqi [4547 1311 6936]
WANG Jiaxin [3769 0857 2450]
WEI Yupu [0604 5148 5543]
GUO Wanling [6753 1238 1545]
TIAN Rongzhang [3944 2837 3864]
CAI Qiang [5591 1730]
JIANG Cixue [5592 2945 7185]
XIA Changqing [1115 7022 3237]

ORG: TONG, WANG, WEI and GUO all of the Department of Basic Courses; TIAN, CAI, JIANG and XIA all of the Department of Metal Materials

TITLE: "The Study of Effects of Antimony and Rare-earth Elements on the Structure and Fracture Toughness K_{IC} of ZL104 Al-Si Alloy Castings"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 38-43

TEXT OF ENGLISH ABSTRACT: This paper studies the effects of adding antimony and rare-earth elements on the structure and fracture toughness of ZL104 Al-Si alloy castings. Specimens of 20 x 40 x 200 mm with fatigue pre-cracking fracture toughness test were used for single edge notched three point loading test. The test results showed that adding the proper amount of antimony enabled the grain structure to become fine and improved the fracture toughness and other mechanical properties.

AUTHOR: LI Juexin [2621 6030 2450]

ORG: Department of Mining and Mineral Engineering

TITLE: "A Study of Different Types of Disturbances of Inertial Vibratory Drawing Ore Machines"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 44-48

TEXT OF ENGLISH ABSTRACT: The present article analyzes the mechanical behavior of vibrating drawing ore machines driven by uniaxial, biaxial, triaxial and four-axial vibrators, points out their advantages and disadvantages and puts forward some principles of their use and design.

AUTHOR: MENG Shuqing [1322 2579 7230]
HUANG Yanzhu [7806 3508 3796]
HE Zhiquan [0149 1807 2938]

ORG: MENG and HUANG both of Central South Institute of Mining and Metallurgy; HE of the Guangxi Metallurgical Research Institute

TITLE: "The Effect of Sodium Carboxymethyl Cellulose on Flotation Separation of Lead and Zinc Minerals"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 49-55

TEXT OF ENGLISH ABSTRACT: In this paper, the effect of sodium carboxymethyl cellulose (CMC) on flotation separation and wettability of galena and sphalerite is described. It has been experimentally proved that CMC depresses sphalerite and galena which are not activated by metal cations, while butyl xanthate is used as a collector at pH 11.5±, and CMC does not depress sphalerite once activated by Cu^{2+}, but depresses galena efficiently. A concentrate with a galena of 71.01 percent lead and recovery of 90.9 percent can be obtained after flotation separation when a synthetic mixed mineral contains 42.95 percent lead.

AUTHOR: None

ORG: The Experiment Group of Blind Raise*

TITLE: "The Determination of the Suitable Interval of Millisecond Initiation in Driving Blind Raise Using Longholes"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 56-62

TEXT OF ENGLISH ABSTRACT: This paper describes a particular method in which a rail is impacted by blasted rock fragments for measuring the falling time in the vacant cavity formed by blasting, and this method is used as a base for determining the suitable interval of millisecond initiation of the individual hole.

This paper also analyzes the effect of the "Complementary Space" formed by uncharged large holes or vacant cavities by blasting on the determination of the interval.

Finally, the proper delay tag number of millisecond detonator is chosen for the individual holes. This, consequently, assures the satisfactory effect in the driving of blind raise using longholes.

* Made up of individuals from the Taolin Lead and Zinc Mine, Hunan Metallurgical Research Institute and Central South Institute of Mining and Metallurgy.

AUTHOR: GAO Yunzhang [7559 0061 4545]
WU Jingu [0702 0093 6253]

ORG: Both of the Department of Mechanical Engineering

TITLE: "Optimization of the Counterweight Balancing Mechanism of Two-roll Tube Cold Rolling Mills"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 63-69

TEXT OF ENGLISH ABSTRACT: This paper describes the formulation of the optimization of the counterweight balancing mechanism of two-roll tube cold rolling mills, and applies the Complex Method to optimize the balancing mechanism of the tube cold rolling mill, model LG-30III. The computer output shows that with the optimum parameters the balance effect of the balancing mechanism rises markedly.

AUTHOR: CHEN Zeren [7115 3419 0088]

ORG: Department of Mechanical Engineering

TITLE: "Some Applications of Rotational Transformation Tensor to Descriptive Geometry"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 70-78

TEXT OF ENGLISH ABSTRACT: In this paper the following are discussed: how to solve the problems of the lines of intersection between a plane and the surface of a solid of revolution and between the surfaces of solids of revolution; and how to solve the problem of the development of the surface by means of rotating transformation tensor. In the paper a typical example of how to get the solution to a problem with optimization and through a computer's supplementary calculus is also given.

AUTHOR: ZHOU Zixing [0719 2737 2502]

ORG: Department of Geology

TITLE: "Reliability Processing of Residual Magnetic Anomaly"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 79-86

TEXT OF ENGLISH ABSTRACT: First this paper analyzes the correlation of the false component (ΔZ_A) in residual magnetic anomaly (ΔZ) to theoretical anomaly by given bodies. Second, a function Z_f can be made in accordance with the property of ΔZ_A. Additionally, Z_f can be computed by changing the factors in the function so as to make Z_f approximate to ΔZ in the domains of space, the wave number and the space-wave number respectively.

The advantages of this method are that the properties of both space-domain and wave number-domain can be used, and that the method to figure the reliability coefficients may be given.

AUTHOR: HUANG Jianchao [7806 0256 6389]
TAN Shusong [6223 2885 2646]
SUN Xiaohua [1327 1321 5478]
LI Shutang [2621 2885 2768]

ORG: All of the Department of Metal Materials

TITLE: "Metallographic Observation of Thermoelastic Martensitic in Cu-Al-Ni Alloys"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 87-94

TEXT OF ENGLISH ABSTRACT: The transformation points of martensite in Cu-14 percent Wt Al-4.2 percent Wt Ni alloy (M_s, M_f, A_s, A_f) have been measured. The microscope thermoelastic martensite transformation of this alloy under a high temperature has been observed. According to the experimental phenomenon which appeared in the transformation process, some views on the formation and figure of martensite are posed.

AUTHOR: D[illegible]oyun [0002 6670 0061]
Z[illegible]Daquan [1728 6671 2938]

ORG: DING of the Central South Institute of Mining and Metallurgy; ZHANG of the Hunan Computing Technology Research Institute

TITLE: "Calculation of the Rare Earth and Transition Metals Phase Diagrams--Calculation of Binary Systems: Y-Zr and Y-Hf"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 95-101

TEXT OF ENGLISH ABSTRACT: According to the regular solution approximation, the binary phase systems of rare earth (yttrium) and refractory transition metals (zirconium and hafnium) are calculated by the use of Kaufman's method. The calculated phase diagrams are compared with the experimental ones, and they are found to be in good agreement.

AUTHOR: RUI Jiagao [5360 0857 6138]

ORG: Department of Basic Courses

TITLE: "The Non-stability for a Class of Integral-Differential Equations with Infinity Delays"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 102-108

TEXT OF ENGLISH ABSTRACT: In this paper we have made a study of the solution of a class of the integral-differential equations with infinity delays by means of the V-functional method and have obtained sufficient conditions of non-stability of zero solution.

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CSO: 4009/287

AUTHOR: HE Mu [0149 3668]
ZHANG Hong [1728 1347]
HU Yongxiang [5170 3057 4382]
HU Suhui [5170 4790 6540]

ORG: All of the Shanghai Institute of Metallurgy, Chinese Academy of Sciences

TITLE: "An Investigation of Nb_3Sn Multifilamentary Superconducting Composites Formed from High-tin-concentration Cu-Sn Alloy"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 1, 1982 pp 17-25

TEXT OF ENGLISH ABSTRACT: By the use of Nb tubes and Sn-Cu alloy, two Nb Sn multifilamentary superconducting composites with 33 and 55 filaments respectively have been fabricated by the internal diffusion method. An investigation has been made on the influences of the different Nb_3Sn reaction diffusion treatments (600°C to 800°C, 1 to 250 hr) and of the additive In on Nb_3Sn layer-thickness growth, grain size and superconducting properties. Experimental results indicate that the stepped-rising temperature treatment is advantageous to the reduction of grain size, and that the ratio of Nb_3Sn layer-thickness growth rate to grain size growth rate is increased by the additive In. Overall current density of Nb_3(Sn In) composite with 55 filaments J_c (4.2 K, 6 T) is about 7.3×10^4 A cm^{-2}.

AUTHOR: MENG Xiaofan [1322 1420 0416]
LI Bo [2621 3134]
BAO Keqin [0545 0344 0530]

ORG: All of the Physics Department, Beijing University

TITLE: "Studies on the Fabrication Technology of Lead Josephson Tunnel Junctions Formed by Thermal Oxidation in High Purity Oxygen"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 1, 1982 pp 26-33

TEXT OF ENGLISH ABSTRACT: This paper principally presents the fabrication procedures of lead Josephson tunnel junctions formed by thermal oxidation in high purity oxygen and reports some experimental results. The junctions formed by this method have high quality, high yield rate and good homogeneity and reproducibility of critical currents. The paper also presents some examination methods of the oxide quality of tunnel junctions.

AUTHOR: LI Jiazhang [2621 0857 3864]
MENG Xiaofan [1322 1420 0416]

ORG: Both of the Physics Department, Beijing University

TITLE: "Experimental Study of the Variation of the Critical Current of the Tunnel Junctions with the External DC Magnetic Field"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 34-41

TEXT OF ENGLISH ABSTRACT: Because the critical current of Josephson tunnel junctions is highly sensitive to the magnetic field, the field can be used to examine the quality of the tunnel junctions. This paper describes an apparatus which measures the variation of the critical current of the tunnel junctions I_c with the external DC magnetic field. The relation between I_c and H is directly shown on an X-Y recorder. The examination results for junctions of different sizes are obtained and discussions are briefly given.

AUTHOR: None

ORG: Section 307, Institute of Plasma Physics, Chinese Academy of Sciences; Superconductivity Group, Cryogenics Section, University of Science and Technology of China; Cryogenics Group, Section Two, Shanghai Institute of Nonferrous Metals

TITLE: "An Experimental Study of Quenching Dynamic Processes of the Unpainted NbTi Composite"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 42-50

TEXT OF ENGLISH ABSTRACT: A study on quenching dynamic processes of the unpainted NbTi composite is made by using the double-solenoid method, obtaining the minimum trigger energy ε_m, the propagation velocities of the normal zone for various biasing magnetic fields in operating currents as well as the parameters I_m, I_p and I^*. The paint film is found to have a marked effect both on the configuration of the volt-ampere characteristics of quenching processes and the characteristic parameters. When the intensity of heat evolution is greater than a certain critical value, a change of propagation is shown in the normal zone from that of one dimension to that of two dimensions.

The double-solenoid method proves practicable in predicting the operation characteristics of the composites, in choosing the working points of the large magnets, and

[Continuation of DIWEN WULI No 1, 1982 pp 42-50]

in making analyses of the stability against the local heat pulses. Therefore, the method is worth being popularized for the regular tests of the performance of superconducting materials.

AUTHOR: YAN Luguang [0917 7120 0342]
MA Hongda [7456 1347 6671]
HAN Yansheng [7281 3601 3932]
LI Huidong [2621 2585 2639]
et al.

ORG: All of the Institute of Electrical Engineering, Chinese Academy of Sciences

TITLE: "Experimental Investigation of an Iron-core Superconducting Solenoid"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 56-64

TEXT OF ENGLISH ABSTRACT: A summmary is made of the experimental results of an iron-core superconducting solenoid with high current density and high field. The tested solenoid has a bore diameter of 400 mm, stored energy of 0.445 MJ and a peak field of about 5 T. The results show clearly that the iron core has the effects of reducing the peak field, increasing the central field and improving field homogeneity and that the winding critical current has also been raised.

AUTHOR: DING Shiying [0002 0013 5391]

ORG: Physics Department, Nanjing University

TITLE: "Ultimate Critical Current Density of Nb_3Al, $Nb_3(AlGe)$ and $V_4(HfZr)$"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 74-77

TEXT OF ENGLISH ABSTRACT: By applying a flux pinning theory, where the ultimate critical current density (J_c) of a superconductor is determined by plastical shearing of flux line lattice, approximate upper limits on J_c of Nb_3Al, $Nb_3(AlGe)$ and $V_4(HfZr)$ are estimated and compared with those of other high-magnetic-field superconductors. Results show that the upper limits on J_c of Nb_3Al are the greatest for magnetic field $B < 26$ T, but $Nb_3(AlGe)$ has the highest upper limit on J_c for $26\ T < B < 38\ T$. We conclude that Nb_3Al and $Nb_3(AlGe)$ are the best potential superconductors in high magnetic field applications.

AUTHOR: SHU Quansheng [5289 3123 5116]

ORG: Zhejiang University

TITLE: "A New Portable Auto-transfer Equipment for Cryo-liquids"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 86-88

TEXT OF ENGLISH ABSTRACT: A new portable auto-transfer equipment for cryo-liquids which we designed is described in this paper. It can transfer the liquids by means of only the pressure produced due to evaporation of the liquid itself without both the power supply and the source of high pressure gas. Its weight is 2.5 kg in all, and the structure is very simple and ingenious. The main part includes three dynamic valves and an evaporation chamber. It has been successfully used to transfer liquid nitrogen, liquid hydrogen and liquid air on a small scale from a Dewar vessel to the cooling apparatus in the fields of low temperature physics, cryo-electronics and infrared techniques.

AUTHOR: GAO Ruifen [7559 3843 5358]
ZHU Zezhi [2612 3419 2535]

ORG: Both of the University of Science and Technology of China

TITLE: "Measurement of Superconducting Critical Field in High Pulsed Magnets"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 89-92

TEXT OF ENGLISH ABSTRACT: The critical field of superconducting wire has been measured. The resistive critical field Hr of NbTi alloy wire is found to be 115 ± 4 kg at 4.2 K. Observations have also been made on the effect of noise, Joule heating and "critical current" on the critical field measurement. One of the high pulsed magnets used can produce the field higher than 400 kg with a pulsed duration of 15.6 msec, and the efficient inside diameter is 25 mm.

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APPLIED SCIENCES

CDMA SATELLITE COMMUNICATIONS SYSTEM ADVANTAGES LISTED

Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese No 1, 1982 pp 19-26

[Article by Mao Yuhai [5403 0060 3189] of Qinghua University: "Some Considerations of the CDMA Satellite Communications System"; this article received by this journal on 29 August 1981, was written in 1980 when the author was working at the RCA Company in the United States]

[Text] This article discusses the possibility of placing a new CDMA communications satellite between two SCPC communications satellites on two orbits 4° apart in space. The article gives the relationship between the power density per bit/noise and the number of users of the CDMA system. It discusses the method of increasing the number of users, calculates the mutual interference of the CDMA system and the SCPC system, and derives the ratio between the power density of maximum interference and the power density of receiver noise for the maximum number of users.

I. Introduction

As satellite communications develop, the number of synchronous communications satellites on the same orbital arc will increase. The smallest distance between two neighboring satellites was originally limited to 4 degrees. If the distance between neighboring satellites is further shortened, intolerable mutual interference will result. Because the frequencies assigned to neighboring satellites are the same, interfering signals will easily enter the side lobes of the ground station antennas.

There are two types of interference: upward interference and downward interference. Upward interference is caused by the transmitter of the ground station. The signals transmitted reach the neighboring satellite through the side lobes of the transmitting antenna of the ground station. Downward interference is caused by the neighboring satellite. The interfering signal enters the receiver of the ground station bia the side lobes of the receiving antenna of the ground station. Because the upward and downward frequencies are different, the transmitting wave lobe diagram and the receiving wave lobe diagram of the same antenna are slightly different.

There are many ways to solve the problem of mutual interference. For example:

1. The electrical level of the side lobe of the antenna can be lessened. The electrical level of the side lobe of a carefully designed parabolic antenna can be as low as -25 to -30 dB; i.e., about 5 to 10 dB lower than that of presently available ground station antennas.

2. A multiple wave beam satellite can be used. It operates under the satellite switched time division multiple access (TDMA) system, thus reducing the interfering signals from the ground stations located outside the pin beam.

3. The problem of mutual interference can be solved using code division multiple access (CDMA) of the expanded frequency spectroscopic technique. This is the purpose of this article.

This article will emphasize the discussion of a satellite communications system with directly sequenced PN code division multiple access.

II. The Number of Users of a Code Division Multiple Access System

We very naturally think of the following problem: on the same marked carrier frequency, can a system of expanded frequency spectra transmitting and occupying the same radiofrequency bandwidth accommodate the same total number of users as an ordinary frequency division multiple access system? In an ordinary frequency division multiple access system, the number of users can be determined by the ratio between the system's bandwidth and the bandwidth of the communications channel. For example, the radiofrequency bandwidth in the SPADE system is 36 MHz. The bandwidth of each channel is 38 KHz. The interval of each carrier wave is 45 KHz, and so the total number of communications channels is equal to 36 MHz/45 KHz = 800.

To determine how many simultaneous users of expanded frequency spectra there can be within a given frequency band, we must mainly rely on calculating the signal-to-noise ratio at the output end of related equipment. But it is very difficult to derive a meaningful and generalized result. Therefore, the following discussion will be limited to the ideal hypothesis of complete statement synchronism and bit synchronism. In addition, the following hypotheses are also made:

1. We assume that the long code is used, or when there are many users, many short codes are used. It is possible in this way to suppose that the effects of other users can be replaced by the Gaussian random process.

2. We assume that the processing gain is very large. This means we assume that the ratio between the expanded bandwidth B_r and the information bandwidth B_m is very large. A large processing gain can make the above hypothesis more reliable--i.e., the effects of other users can be regarded as blank noise processes in the data bandwidth.

These hypotheses are relatively conservative.

Let the receiving signal power be P_r and the bandwidth of the receiver be B_r; the receiving signal power density then is equal to P_r / B_r, and the mutual interference noise of the other n - 1 users N_m is equal to

$$N_m = \frac{n-1}{n} \cdot \frac{P_r}{B_r} \approx \frac{P_r}{B_r} \tag{1}$$

where n is the number of simultaneous users. If the receiver noise power density is represented by N_r, then the total noise power density N_o equals

$$N_o = N_r + N_m = N_r + \frac{P_r}{B_r} \tag{2}$$

If the signal power received by a single user equals P_r/n, then the signal energy E_b per bit equals

$$E_b = \frac{P_r}{n} \cdot \frac{1}{R_b} \tag{3}$$

where R_b is the bit code rate of the information code. Now we can write the ratio of the power density of each bit of energy and noise as follows:

$$\frac{E_b}{N_o} = \frac{P_r}{n} \frac{1}{R_b (N_r + N_m)} = \frac{N_m B_r}{n R_b (N_r + N_m)} \quad . \tag{4}$$

The information bandwidth B_m equals $2R_b$. The processing gain G of the direct PN code system equals the ratio between the system's bandwidth and the information bandwidth. Although there are many other formulas which can more accurately compute the processing gain (for example, refer to reference 1), this is sufficient for engineering estimates. Therefore, equation (4) can be rewritten as

$$\frac{E_b}{N_o} = \frac{2G\alpha}{n(1+\alpha)} \tag{5}$$

where $\alpha = N_m / N_r$. It is the multiple of the power density of mutual interference over the receiver noise density.

E_b / N_o takes the processing gain G and the power density ratio α as parametric variables. The curve of the relationship between it and n is shown in Diagrams 1 through 3. They correspond respectively to G = 500, 1000, and 2000.

If we assume that the added noise in the communications channel is blank Gaussian noise, then the bit error probability is

$$P_E = (1/2 \text{ erfc } [(E_b/N_o)^{1/2}] \quad (6)$$

where erfc is the error function, defined as

$$\text{erf } (x) = \frac{2}{\pi} \int_x^{\infty} \exp(-u^2)\, du \quad (7)$$

From equations (6) and (5) we can obtain the relationship between P_E and n, as shown in Diagrams 4 to 6, which correspond respectively to G + 500, 1000, and 2000.

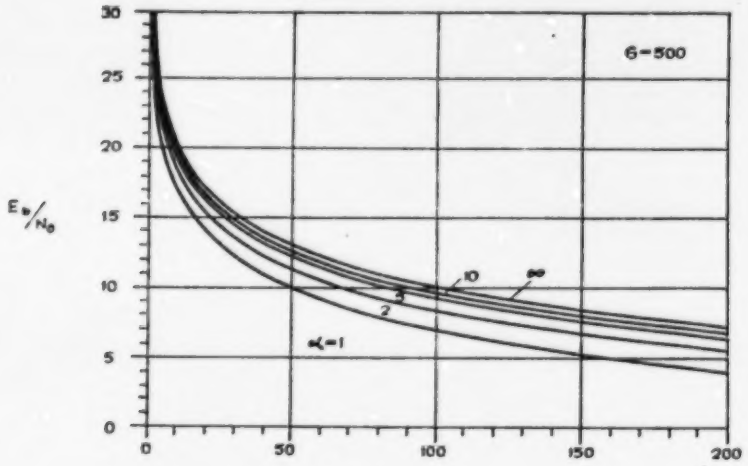

Diagram 1

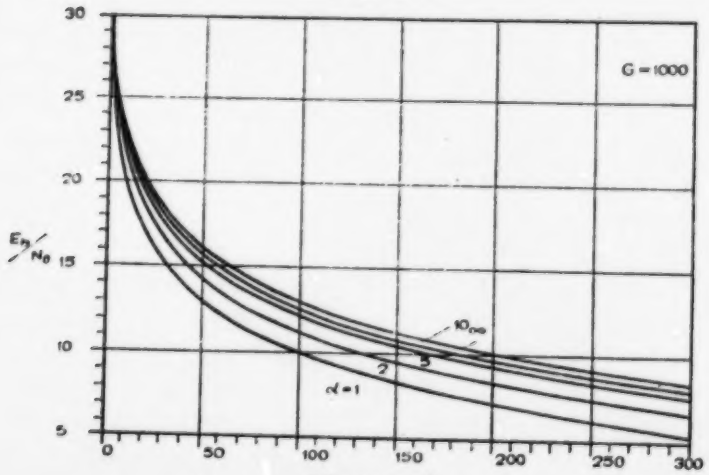

Diagram 2

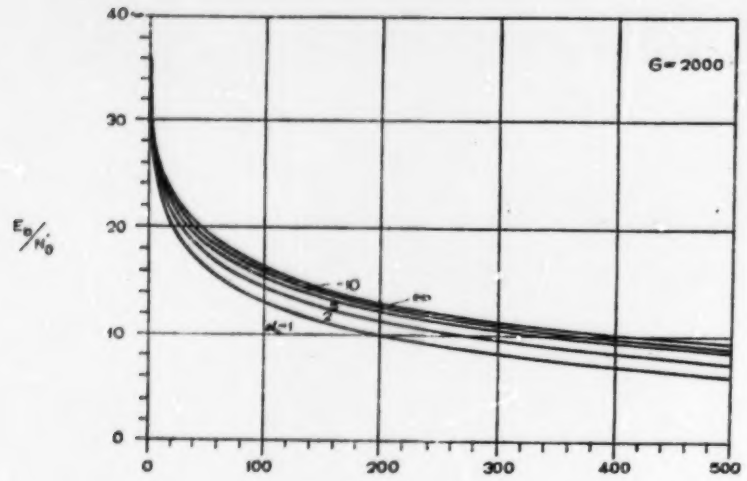

Diagram 3

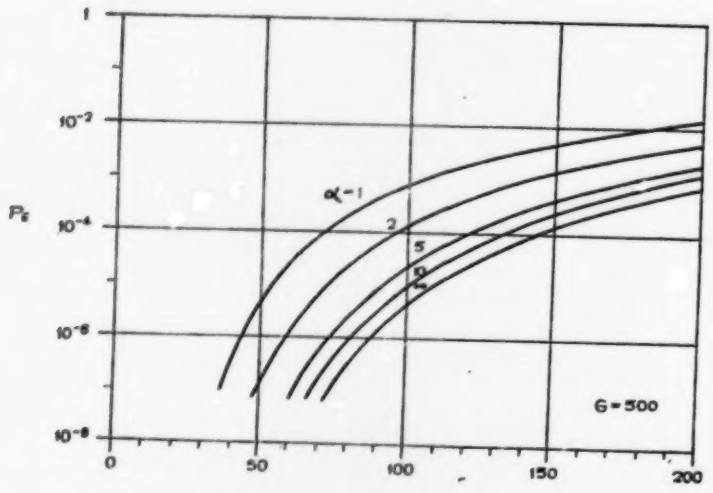

Diagram 4

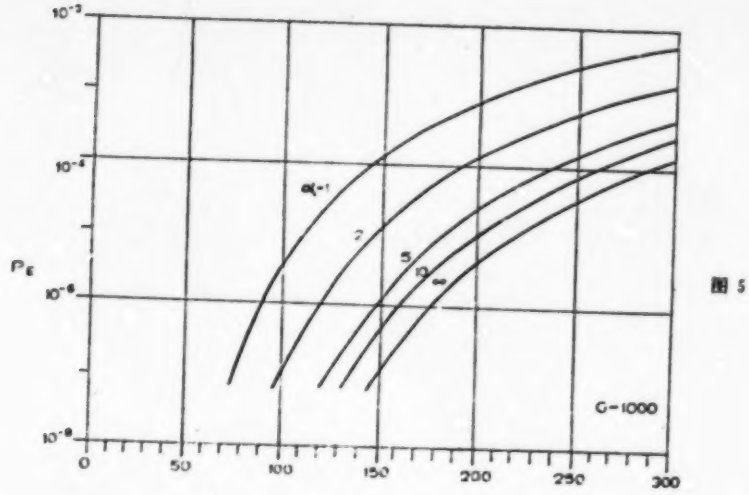

图 5

Diagram 5

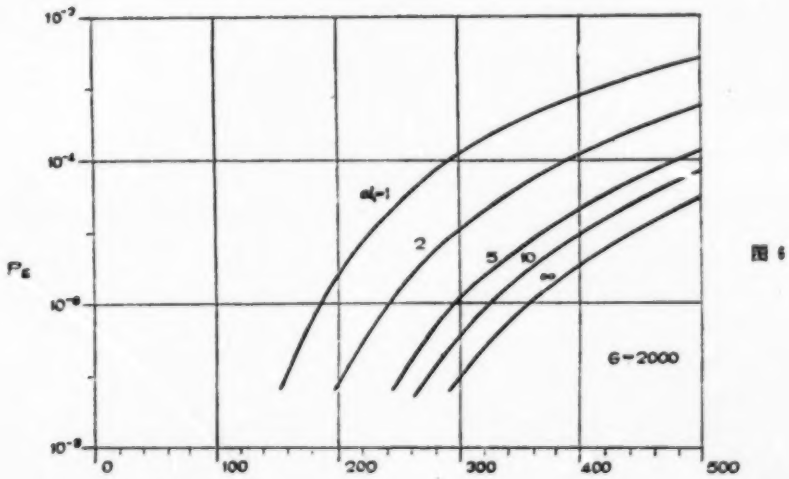

图 6

Diagram 6

III. The Method of Increasing the Number of Users

First, let us decide on the processing gain of an actual code division multiple access (CDMA) system.

The bandwidth of the receiver equals 36 MHz. This is determined by the actual satellite retransmitter. The bandwidth of information is determined by the method of modulation. The PCM code rate is the highest. If the sampling rate of the voice channel is 8,000 samples/second, and each sample is quantified as 7 bits plus 1 bit as the added signal, then the digital code rate is 64 kilobits/second. The code rate of Δ modulation is far smaller than ordinary PCM. The digital code rate of the DET-56 digital ground station is 32 kilobits/second. When the digital code rate is reduced to 16 kilobits/second, acceptable voice quality can still be maintained. Therefore, we first consider Δ modulation here.

Although the bandwidth of QPSK is only one-half of the BPSK when the data rate is the same, the processing gain of direct PN code division multiple access is the same, regardless of whether it is in QPSK or BPSK. The reason is that the processing gain is determined by the span-versus-width ratio of the frequency band, and so therefore conservation of the bandwidth will not benefit the expansion of the frequency band. Concretely, in the situation we are discussing, the limit of the radiofrequency bandwidth is 36 MHz. After using QPSK, the rate of the PN code can be allowed to increase onefold. This means that for QPSK, R_c = 36 MHz, but for BPSK, R_c = 18 MHz. But the bandwidth of the two systems is the same, and so the processing gain is the same for both systems. If we use Δ modulation, the information code rate is 32 kilobits/second, then the processing gain is generally equal to 500. If the information rate is reduced to 18 kilobits/second, then its processing gain will approach 1000. It can clearly be seen in Diagrams 1 through 3 that when the ratio of the power of each bit versus noise E_b/N_o is given, the number of simultaneous users is determined by the processing gain G and the ratio α between the mutually interfering noise and the receiver noise. If E_b/N_o = 10 dB, G = 500, α = 1 are given, then the number of simultaneous users is only 50. If α increases from 1 to ∞, then the number of users can increase from 50 to 100. If G increases from 500 to 1000, then at $\alpha = \infty$ the number of users can increase from 100 to 200.

The required E_b/N_o is determined by the allowable bit error probability. Therefore, using the error-correcting code can also increase the number of users. The most effective error-correcting code is the convolutional code with software decided Viterbi decoding. Concretely speaking, we have considered the convolutional code with 8-level software decided Viterbi decoding. Its limiting length is K = 7, and its rate is R = 1/2. The accompanying table 2 lists the performance of this type of code in the added blank Gaussian noise when the error code rate is from 10^{-6} to 10^{-3}. Yet, using error correcting codes will cause the frequency band to expand, and the processing gain will be lowered. For example, the convolutional code of K = 7 and R = 1/2 will expand the information bandwidth to onefold the original bandwidth. This means the processing gain will be reduced by onefold. Yet, even when the processing gain is reduced, the number of users will still increase. For

example, if G = 1000, α = 1, the required error code rate would be 10^{-6}, and this corresponds to the required E_b/N_0 = 10.5 dB before coding. We can obtain the number of users from Diagram 2 to be about 85. Yet, if error-correcting codes are used, the required E_b/N_0 will be reduced to 5.0 dB. Even though at this time the processing gain has dropped to 500, the final number of users can still be increased to 160 (see Diagram 1). But this number is still far lower than that of the frequency division multiple access (FDMA) system. In this example, the frequency spectrum utilization rate is low because it contains the hidden hypothesis that all users are continuously operating, or at least are operating at a very high work ratio. In this situation, the system of expanded frequency spectra usually cannot utilize the frequency spectra very effectively. Yet almost as early as 20 years ago, Costas 3 had already proven the following conclusion: If we want a group of stations to be able to work anytime, but each station works only a short period, the broadband system must provide a greater communications capacity and a greater frequency spectra utilization rate with a narrowband system.

具有 Viterbi 解码和软判决的褶积码($K=7$, $R=1/2$) 的性能

1 误码率	2 未编码	3 编码后
P_e	E_b/N_0	E_b/N_0
10^{-3}	10.5 dB	5.0 dB
10^{-4}	9.6 dB	4.5 dB
10^{-5}	8.4 dB	3.8 dB
10^{-6}	6.8 dB	3.0 dB

Performance of a Viterbi decoding and software decided convolutional code (K = 7, R = 1/2)

Key:

1. Error-code rate
2. Uncoded
3. Coded

When operating in a crowded frequency band, different tasks are often assigned to different frequency bands while the user is allowed to operate on any frequency in the frequency band. Costa proved that when the communications capacity of the broadband system surpasses that of the narrowband system. The capacity can be represented by the following formula

$$C_B = C_N \left[1/d(S/N)_{min}\right] \tag{8}$$

Where C_B, C_N = the communications channel capacities of the broadband and the narrowband in operation, d = the average work ratio of each station, and

$(S/N)_{min}$ = the estimated most unfavorable signal-to-noise ratio in the narrowband system.

It can be seen from equation (8) that as the work ratio drops, the superiority of performance of the broadband system over that of the narrowband system increases.

When all the users are able to operate at their assigned frequencies, Costas also proved that a similar relationship exists--i.e., when the different assigned tasks are given a bandwidth, the broadband system that operates at a low work ratio can provide a larger communications capacity. The reason is that when the work ratio is low, at any given instant most of the assigned communications channels are free, and so therefore the narrowband system creates a waste of the frequency spectra. This is unavoidable, however, because each station is prepared to use the channels at any time. This type of narrowband distribution eliminates interference between users. In the broadband, the influence of each station on the other station is like "noise"; therefore, it can benefit from a low work ratio. So long as the average electrical level of the "noise" does not surpass the allowable capacity limits, the number of users of the system can be increased.

Ordinarily, it is very difficult to calculate accurately the number of users at a low work ratio. This is because it is determined by the distribution of the operating time of the users. This kind of distribution can be measured in an actual satellite communications system. A mathematical model can be obtained from the measured data. But we can obtain a rough estimate from equation (8). The number of users of a communications system of expanded frequency spectra is inversely proportional to the work ratio. The average work ratio of an actual satellite communications system during the daytime is about 0.25. Therefore, the potential number of users is about 4 times the number of simultaneous users. Concretely speaking, in the examples we have cited it is possible to have 600 potential users.

IV. Interference of the Current SCPC System by the CDMA Satellite Communications System

The signals of the expanded frequency spectra enter the current SCPC system via the side lobes of the ground station antennas. The gain of the side lobe of the ground station antenna is given by the following formula:

$$G(\theta) = 32-25 \log \theta^0 \text{ (dB)} \qquad (9)$$

The newly added satellite is 2 degrees away from the present satellite. Substituting into equation (9), we obtain $G(2^0) = 32-25 \log 2 = 24.5$ dB. The gain of the main lobe of a standard ground station antenna is 43 dB at 4 GHz, and 46 dB at 6 GHz. Therefore, the difference between the electrical levels of the upward and downward side lobes is 3 dB. In the worst case, the electrical level of the side lobe is lower than the electrical level of the main lobe by $g(2^0) = -18.5$ dB (i.e., 0.014).

According to the hypothesis in Section 2, the signal of the expanded frequency spectrum can be simulated by Gaussian blank noise with a power density of N_m . Therefore, the interference power density received by the present SCPC ground station is $g(2^0)\ \ N_m = 0.01\ 4N_m$. This is equivalent to increasing the power density of noise of the ground station by one factor, equal to $[1 + g(2^0)\ \alpha\ ] = (1 + 0.014\alpha\ )$. This will reduce the number of effective users of the SCPC system by the same factor, because an increase in the noise power means an increase in the carrier wave power. But the total power is limited by the specified power of the carrier wave tube, and so its number of carrier waves must be reduced.

Therefore, if we increase the power density ratio α , then although the number of users of the CDMA system can be increased (See Diagrams 1 through 3), the interference of the present SCPC system will also increase. Therefore, the total number of users will increase at a smaller α . When α increases further, the number will reduce. When we insert a new CDMA communications satellite, two of the existing neighboring satellites (carrying the SCPC communications system) will both receive interference. Therefore, the total number of users n_o can be determined by the following formula:

$$n_o = \frac{2\ G\ \alpha}{\frac{E_b}{N_o}\ (1 + \alpha)} + \frac{2\ N_s}{1 + g(\theta)\alpha} \qquad (10)$$

where n_s is the number of communications channels of the SCPC system. If the number of communications channels of the SPADE system $n_s = 800$, $g(\theta) = 0.014$, then substituting into equation (10) we can draw the relationship between n_o and α when $(E_b\ /N_o)$ and G are used as parametric variables. The results are shown in Diagrams 7, 8, and 9.

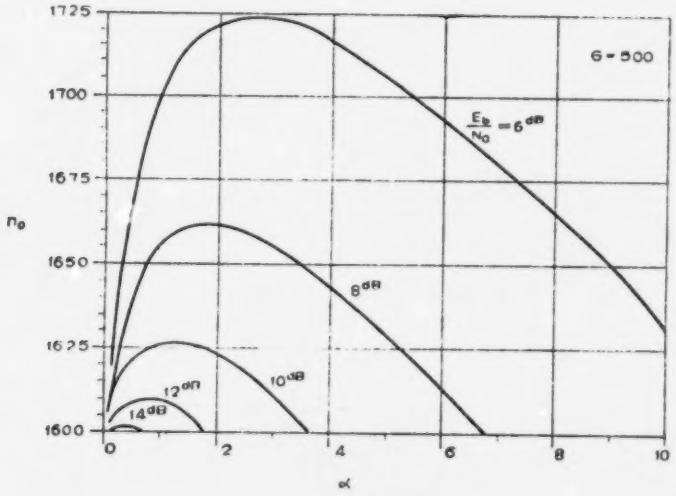

Diagram 7

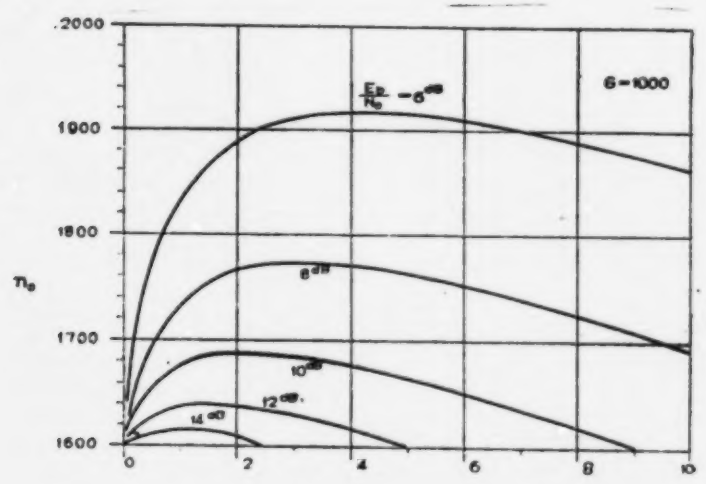

Diagram 8

We can draw the following conclusions from these curves:

(1) There is a maximum value on each curve.

(2) When the processing gain is relatively low, the maximum value is more sensitive to α .

(3) When the required E_b / N_0 is reduced, the maximum value of α will increase.

(4) When G = 500, within the range of the values of E_b / N_0 that we are actually interested in, the value of α is between 1 and 3.

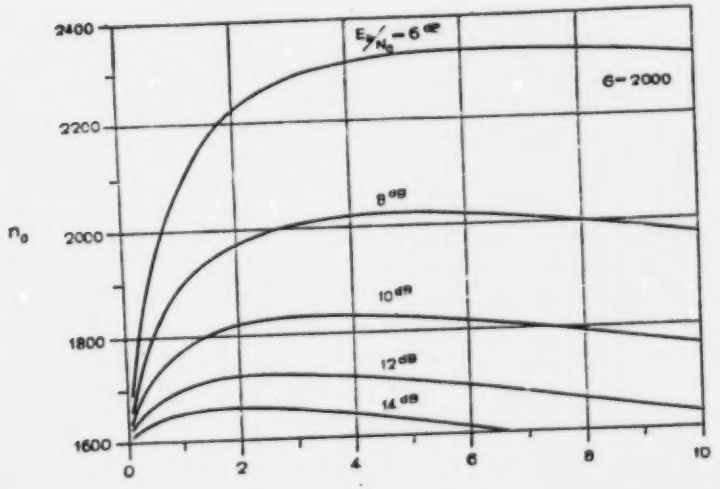

Diagram 9

V. Interference of the CDMA System by the SCPC System

There are many carrier waves within the radiofrequency bandwidth of the SCPC Sytem. If the radiofrequency band of the SCPC system completely overlaps the CDMA system, this type of evenly distributed small carrier waves can be approximately regarded as being Gaussian blank noise. With this assumption, the calculation of the interference of the CDMA system by the SCPC system becomes very simple.

The interference signals of the SCPC system also enter the CDMA system via the side lobes of the ground station antennas of the CDMA system. They will also cause the power density of equivalent noise at the receiver to increase by a multiple of $[1 + g(\theta)P_c / N_r B_c]$, where P_c / B_c is the carrier wave power density of each communications channel of the SCPC system. This will cause the the parameter α to drop by the same multiple. For example, if $P_c / B_c N_r = C/N_0 = 12$ dB and $g(\theta) = 0.014$, this factor will equal 1.151. It can be seen from Diagrams 1 through 3 that α is reduced by 1.15 times, and this will not visibly worsen the CDMA system. If we hope to obtain a more accurate computation, we can substitute the new value of α into the previous formula, and the result obtained will correspondingly change.

VI. Conclusion

It is possible to add a CDMA communications satellite between two SCPC communications satellites without worsening the performance of the former. The number of users of the CDMA communications system must be fewer than the number of users of the SCPC system. Yet the number of users of the CDMA system can be increased by using error-correcting codes. The potential number of users is comparable to that of the SCPC system. Many other advantages (such as ability to resist interference, ability to resist attenuation, etc.) make the CDMA system especially suitable for use as a special-purpose communications system.

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POWER SEMICONDUCTOR DEVICE APPLICATIONS REVIEWED

Xian DIANLI DIANZI JISHU [POWER ELECTRONICS] in Chinese No 1, 1982, p 35-41

[Article by Zhang Weizuo [1728 3634 0146] of the Xian Rectifier Research Institute: "The Development of Electrical Semiconductor Devices as Seen in Electrical Appliances for Everyday Use"]

[Text] During the past 2 years, our nation's ordinary, everyday electrical appliances have developed rapidly. They had made corresponding demands for various types of low-power thyratron transistors. On this basis, many manufacturers are competing to produce these types of devices. This article will introduce in general those devices which are related to everyday electrical appliances; emphasis will be placed on a further description of the bidirectional thyratron transistor and related triggering devices. Some immature views on the varieties and direction of development and the key points of related technologies will be presented.

I. The Demand Made by the Development of Daily Electrical Appliances Upon Electrical Semiconductor Devices

There are many kinds of electrical appliances for everyday use, but in general, such electrical appliances that utilize electrical semiconductor devices can be divided into three major categories for controlling electrical motors, for temperature control, and for brightness control. There are other people who have classified them further into seven categories, as Table 1 shows.

Obviously, Table 1 shows many applications, but it still does not include all electrical devices for daily use that are being developed domestically and abroad. Some devices are comprehensive controlling devices belonging to several categories, and to list them in a certain controller category would not be precise enough. But Table 1 also shows a general view and the important function of electrical semiconductor devices in electrical applicances for daily use. The electrical semiconductor devices discussed here refer mainly to the various thryatron transistors. If we included the transistor, the diode, the voltage stabilizer, the range would be even broader. But according to reports, household appliances tend to use the thyratron transistor. This is the result of the rapid development of household electrical appliances toward sophistication. Some simply electrical devices use the diode to chop off the half-wave, and its control fuction obviously is not as continuous as that of the thyratron transistor. In phase control, the number of components used

by the thyratron transistor or the bidirectional thyratron transistor is less than those of the transistor, and the power is low. These are all reasons for the rapid development of the various types of thyratron transistors used in household appliances.

Table 1 Range of Application in Everday Electrical Devices, Function of the Electrical Circuits and Suitable Devices

表 1 日用电器的应用领域、电路机能及适用器件

(1) 应用领域	(9) 具体应用	(17) 电路机能	(25) 适用器件
(2) 电动机控制	(10) 电扇、洗衣机、吸尘器、电动缝纫机、电动工具、空调风机、排风机、电动玩具、搅拌器	(18) 相位控制	(26) 双向晶闸管、普通晶闸管
(3) 温度控制	(11) 电熨斗、吹风机、保温器、电气毛毯、电褥、电热杯、电热梳，电烙铁、各种电炉烤炉电子灶	(19) 相控及通断控制	(27) 双向晶闸管
(4) 光控制	(12) 白炽灯萤光灯调光、广告照明，交通信号、显示装置、照相用闪光器、音乐闪光装置	(20) 相控及通断控制、斩波器	(28) 双向晶闸管、普通晶闸管
(5) 脉冲控制	(13) 煤气炉、煤气灯点火、萤光灯、钠灯启动、汽车点火	(21) 直流开关	可关断晶闸管、普通晶闸管、双向晶闸管、硅对称开关 (29)
(6) 电源开关及控制	(14) 电视电源调节器、汽车电源调节器、充电器、冰箱、定时器、固态继电器、门自动开关、抚摸式开关、微波灶	(22) 相位控制、斩波器、通断控制、开关	普通晶闸管 程控单结晶体管 双向晶闸管 (30)
(7) 防灾机器	(15) 火警器、煤气警报器、漏电断路器	(23) 直流开关	普通晶闸管 可关断晶闸管 (31)
(8) 频率变换	(16) 电视水平偏转、电磁灶、超声洗涤器、电子乐器	(24) 逆变器	可关断晶闸管 不对称可控硅 逆导晶闸管 (32)

Key:

1. Range of Application
2. Controlling electrical motors
3. Temperature control
4. Light control
5. Pulse control
6. Power source switch and control
7. Disaster prevention devices
8. Frequency changes
9. Actual applications

Key continued:

10. Electric fans, clothes washers, vacuum cleaners, electrical sewing machines, electrical tools, air conditioning ventilators, air ventilators, electrical toys, mixers
11. Electric irons, blowers, thermostats, electric blankets, electric mattresses, thermoelectric cups, thermoelectric combs, electric irons, various electric stoves, electric ovens, electronic stoves.
12. Ordinary light bulb and fluorescent lamp dimmers, lighting for billboards and neon lights, traffic signals, display devices, photographic flashes, visual color synthesizers for stereo music.
13. Coal gas burners, igniting devices for coal gas lamps, turning on fluorescent lamps and sodium lamps, automobile ignitions
14. Television power source regulators, automobile power source regulators, chargers, refrigerators, timers, solid state relays, automatic door-opener switches, touch-operated switches, microwave ovens
15. Fire alarms, coal gas alarms, leakage circuit breakers
16. Television horizontal dials, electromagnetic stoves, supersonic washers, electronic musical instruments
17. Functions of circuits
18. Phase control
19. Phase control and on-off control
20. Phase control and on-off control, wave chopper
21. Direct current switching
22. Phase control, wave chopper, on-off control, switching
23. Direct current switching
24. Inverse transformer
25. Suitable devices
26. Bidirectional thyratron transistor, ordinary thyratron transistor
27. Bidirectional thyratron transistor
28. Bidirectional thyratron transistor, ordinary thyratron transistor
29. Thyratron transistor that can be switched off, ordinary thyratron transistor, bidirectional thyratron transistor, silicon symmetric switches
30. Ordinary thyratron transistor, process control unijunction transistor, bidirectional thyratron transistor
31. Ordinary thyratron transistor, thyratron transistor that can be switched off
32. Thyratron transistor that can be switched off, asymmetric silicon controller, reverse thyratron transistor

1. Control of Electric Motors

In controlling electric motors, the most familiar are the electric fan and the clothes washer. The variation in the speed of ordinary electric fans is generally between 60 percent and 80 percent. Using semiconductor devices to regulate speed can reduce the maximum speed of revolution to below 30 percent. Also, a starting compensator circuit can be used to increase the conducting angle of the bidirectional thyratron transistor at low speed when starting to overcome frictional torque. Besides using the bidirectional thyratron transistor for phasing and for speed regulation, ordinary thyratron transistor

can also be used as a switch to switch the excited magnetic head of the electric motor to realize speed regulation, and the thyratron transistor can be controlled by a small electric current from the human body touching a face-board, thus grounding the current for switching.

Speed regulation in a clothes washer makes it easy for the machine to wash different types of materials (foreign nations believe there are 10 different types of materials, and the speed of revolution required is from 170 rpm to 500 rpm). Because the types of materials are different, the amount of clothing is different, and the amount of water is different, thus under a fixed operating voltage the torque of the load frequently changes, and therefore it is important to use speed feedback for automatic control. In the fully automatic clothes washer which uses a microcomputer, the valves and the clockwise and counterclockwise rotation of the electric motor can be realized by a ampere bidirectional thyratron transistor, as shown in Diagram 1. As everyone knows, five bidirectional thyratron transistors can completely control the clockwise and counterclockwise rotation of the electric motor.

Another example of the popular use of the bidirectional thyratron transistor in electrical devices in daily use is the copier. Besides the electric motor that feeds the paper, the bidirectional thyratron transistor can control the high voltage for static electricity, the light source for image fixing, etc. as shown in Diagram 2. Of course, the power pact still requires the use of rectifiers and voltage stabilizers.

Diagram 1 Block diagram of a fully automatic clothes washer

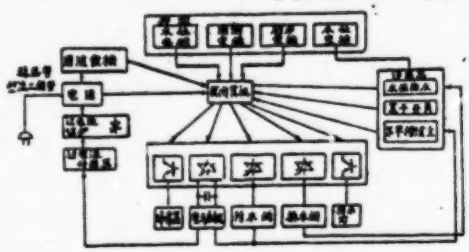


图 1.全自动洗衣机方框图

Diagram 2 Block diagram of a copier

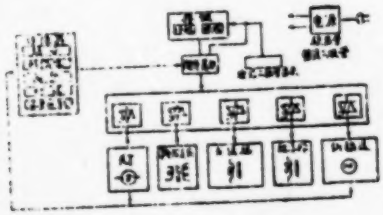


图 2.复印机方框图

A bidirectional thyratron transistor for phasing and speed regulation in vacuum cleaners can regulate the input power at will between 100 watts and 500 watts. This enables the vacuum cleaner to suck in larger dust particles and can also conserve electricity.

Electric sewing machines generally use ordinary thyratron transistors for control. They also have a speed feedback circuit. The advantages are as follows: When the power is turned on and the speed of revolution of the motor is slow, the torque is high at low revolution speeds and the variation in speed caused by the load is small. Of course, the speed can be adjusted at will.

The classical example of an electric tool is the adjustable speed, handheld electric drill which uses a bidirectional thyratron transistor or ordinary thyratron transistor to realize phasing and speed regulation. But if ordinary thyratron transistors are used for half-wave control, the maximum output voltage is only half the voltage of the power source; therefore the coil of the electric motor must be redesigned. The speed-regulation circuit of the bidirectional thyratron transistor can be installed inside the handle of a handheld electric drill.

Air-conditioning equipment and kitchen ventilation shafts can all be fitted with an air ventilator with variable speed control.

2. Temperature control

There are many varieties of everyday electrical appliances that use temperature controllers. The methods of control are mostly the same. Generally speaking, there are two types; the phasing control, and the on-off control. The latter uses an over-zero trigger and is not affected by radiofrequency interference. It is also called a power adjuster. Because it is controlled by alternating current, the bidirectional thyratron transistor is especially suitable for use in temperature control.

At present, the more common device is the temperature-controlled iron. Electric mattresses have recently been introduced on the market. The temperature of the blowers of course can be adjusted. Except in industrial applications, there is still difficulty in popularizing those blowers, as they consume a lot of electricity in households.

3. Light control

Generally speaking, light adjustment is only phase control. It is estimated that light adjustment would be the most popular application, because the price of the controller is cheap, every family must use light bulbs, and all lamps, table lamps and wall lamps can be regulated. Our nation uses a lot of fluorescent lamps, and the bidirectional thyratron transistor can similarly be used to adjust the light of fluorescent lamps, as shown in Diagram 3. According to reports, Japan started out using regulators for fluorescent lamps in large buildings, conference rooms, and theaters, but now these regulators have become popular in ordinary households, teahouses, and restaurants. The silicon symmetric switch (SSS) can also be used for turning on fluorescent

lamps, as shown in Diagram 4. The bidirectional thyratron transistor is also used for turning on lights. It is characterized by a short starting time (reducing the time from the ordinary 3 to 5 seconds to 0.5 seconds). It has a long and useful life, and its price in Japan is about one and a half times the price of a starter.

Diagram 3 Example of adjusting the brightness of a fluorescent lamp

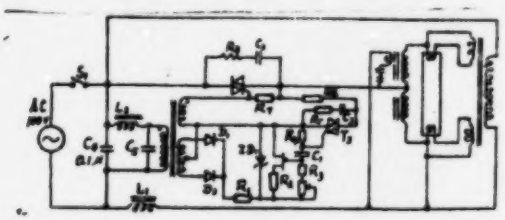


图 3.荧光灯调光例

Diagram 4 Example of starting a fluorescent lamp

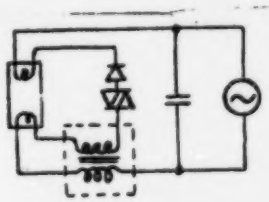


图 4.荧光灯启动例

4. Other types of control

The thyratron transistor is also used in television sets, tape recorders, and video recorders. The power source circuit of a television set can use a phase control of a wave chopper. The horizontal adjuster circuit can suitably utilize a thyratron transistor that can be switched off and a reverse thyratron transistor. The casette tape recorder can utilize the thyratron transistor for automatic shutoff, automatic reverse, and automatic ejection control.

Refrigerators can use the bidirectional thyratron transistor for startup to reduce noise, and they can also use it as a switch for the defroster.

Induction heating can be used in the electromagnetic stove. In such stoves, only the cooking pot is the heat-emitting body. According to reports, heating is rapid and such stoves are most suitable for stir-frying food. The emergence of the asymmetric thyratron transistor (ASCR) has provided a type of device with a relatively high frequency and is suitable for induction heating.

Electronic games and toys frequently use a combination of various types of controls, such as electric motor controls, switch controls, light controls, etc.

Table 1 lists the functions of the circuits and the suitable devices of the various types of controls. It can be seen from the table that the most common are phase controls and on-off controls. Therefore, the bidirectional thyratron transistor occupies a very important position in electrical devices for daily use. The following section will center on an introduction to the bidirectional thyratron transistor.

The small power thyratron transistor is also a device that is broadly used. But in many situations it can be replaced by the process-control unijunction transistor (PUT), because PUT has a very small triggering current. But the transverse PUT voltage is relatively low.

The ideal device for a direct current switch is the thyratron transistor that can be switched off. Foreign nations are developing high-voltage and large-current thyratron transistors that can be switched off, and they are also developing low-power thyratron transistors that can be turned on and switched off with similar ease. The thyratron transistor that can be switched off is also suitable for use in inverters and wave-chopping circuits.

The use of reverse thyratron transistors for wave chopping is rational, but there seems to be less development of low-power reversing devices. The asymmetric thyratron transistor is a five-layer device specifically developed to regulate frequencies.

As new devices develop and as their cost drops, applications in these aspects will undergo more development. Triggering devices must be given more emphasis because they will more effectively develop the advantages of the main circuit elements. For example, better phasing can be obtained when a bidirectional thyratron transistor is controlled by a unijunction transistor, but frequently a transformer must be used, thus increasing the cost, size and weight of the triggering circuit. If the thyratron transistor that can be switched off is fitted with special devices, switching off can be more convenient. The third section of this article will present a general introduction to various triggering devices.

The various functions of the circuits listed in Table 2 show that electrical devices for daily use have utilized almost all of the various, commonly used circuits of electrical and electronics technology. In application, these devices also possess the same original advantages of electrical and electronic technology (such as energy conservation) and disadvantages (such as interference). Therefore, the problem of how to further develop the advantages and overcome the shortcomings still exists. The control of electrical devices for everyday use is an important link in electrical and electronic technology and an important aspect in the application of electrical and electronic sciences in the realm of small-power devices.

The 1981 annual meeting of the national electrical and electronic science conference, held in Dalian, resolved to advance the study of electrical and electronic technology to serve everyday electrical devices and the light and textile industries. New technologies must be used. The percentage of finished products must be improved. The cost must be lowered to solve the problems

in production techniques for small-power components. At the same time, the meeting also proposed that electrical appliances for daily use must be "reliable, cheap, and safe." These require the manufacturing units to greatly improve the reliability of the components, reduce the prices considerably, and add parts to these products to suppress interference. (In general, the use of an induction capacitor can greatly suppress radiofrequency interference.)

II. Development, Principle, Manufacture, and Application of the Bidirectional Thyratron Transistor

1. Development

The bidirectional thyratron transistor emerged as a type of ideal alternating current control device. In 1963 it was first proposed that only four components would be sufficient to control alternating current, and the proposal received a lot of attention (as shown in Table 2). Commercial production of the thyratron transistor began in 1965 abroad. Our nation began test-producing the first bidirectional thyratron transistor prototype in 1966. The gap was not very large. But later, our nation emphasized the development of high-power bidirectional thyratron transistors, and only in recent years did we begin to emphasize small power bidirectional thyratron transistors for every-day electrical appliances.

The major direction of research in the bidirectional thyratron transistor was to solve the problem in the capability of directional change; therefore, many types of different designs and technological structures emerged. One of the more successful among them was the light-triggered bidirectional thyratron transistor.

The main concern with the low-power bidirectional thyratron transitor was how to solve the problems of producing a high percentage of finished products and of reducing the production costs. Our nation's everyday electrical appliances use 220 volts, but they must use components that draw over 400 volts. Household appliances of foreign nations frequently use a power source of 100 volts, and so components using only 200 volts are needed. This is undoubtedly a factor that is unfavorable to an increase in the percentage of finished products from our nation's manufacturers of components. The use of glass inactivation and plastic sealing benefits reliability and is cheap, but the cost of plastic sealing techniques is frequently related to the size of batch production. Distributing the production of components undoubtedly a factor that is unfavorable to any price reduction.

2. Principle

The operating principle of the bidirectional thyratron transistor has been introduced in some books, and it will not be repeated in much detail here. But many comrades hope that we can give a further description of the mechanism of the third quadrant, because this is relatively unfamiliar to manufactuers and users of ordinary thyratron transistors.

Both the positive and the negative directions of the bidirectional thyratron transistor can trigger conduction. Because the positive direction is in the first quadrant in the volt-ampere characteristic graph, it is called I (i.e., T_1 is positive, T_2 is negative). The negative direction is in the third quadrant in the volt-ampere characteristic graph; therefore it is called III (i.e., T_2 is positive, T_1 is negative).

The gate of the bidirectional thyratron transistor corresponding to the T_2 pole can be positive or negative. Thus the method of triggering conduction can be divided into I_+ , I_- , III_+ , III_- .

The I_+ triggering method is similar to the triggering mechanism of ordinary thyratron transistors.

The I_- triggering method is equivalent to first using the T_2 pole as the gate to trigger the thyratron transistor at the gate (such as the P_1 N_1 P_2 N_3 in Diagram 5). Then, via the transverse extention of the conduction zone, the main thyratron transistor P_1 N_1 P_2 N_2 conducts. This is similar to the extension in the conducting zone of the amplification gate in the thyratron transistor.

What is less easily understood is why we can use a gate near the T_2 pole (equivalent to the cathode of an ordinary thyratron transistor] to control reverse conduction! During positive conduction, the cathode N_2 region is very close to the gate, while in negative conduction the cathode N_4 region is very far away from the date. Therefore this has been called "remote control". The following explains the principles of control of the "remote gate."

Taking the III_- triggering method as an example and referring to Diagram 5, we see that this time T_2 is positive and T_1 is negative. At the same time, gate G is more negative than T_2. First, because T_2 is positive, G is negative, a current flows through the P_2 N_3 node; thus the electrons of N_3 are injected into the P_2 zone. To the N_3 P_2 N_1 transistor, N_3 is the emiting pole. The emitted electrons are gathered by the integrated circuit pole N_1. Because T_2 is positive and T_1 is negative, the P_2 N_1 node is in the positive direction; i.e., the integrated circuit pole of the N_3 P_2 N_1 transistor is in the positive direction. It should be pointed out that the integrated circuit pole node in the positive direction also has an electron-gathering function. This can be understood by noting that the integrated circuit pole is positive when the transistor is in a saturated state. If we go a step further and draw the potential hill graph, we can also see that the potential barrier of the node in the positive direction still benefits the gathering of the few electrons in the base region.

After N_1 gathers the electrons, the polarity at P_2 near N_1 is more negative, causing the P_2 N_1 node to be positively biased. Thus, injection of the empty cavity begins from P_2 toward N_1. The P_2 N_1 P_1 transistor acts at this time, and P_1 gathers the empty cavity emitted from P_2.

These empty cavities will flow towards T_1. Attention: In the beginning, these currents will flow transversely past the base region of the P_1 zone, and when the bias voltage IR produced on the resistor R in this base region is sufficiently large, P_1 N_4 will be positively biased. Thus, electrons begin their injection into N_4.

Because the two transistors N_4 P_1 N_1 and P_2 N_1 P_1 have all begun to operate, the current will gradually increase. The amplification coefficients of the two transistors will also gradually increase. When $\alpha_1 + \alpha_2 \geq 1$, P_2 N_1 P_1 N_4 will conduct. This is the principle of reverse conduction of the bidirectional thyratron transistor.

It can be seen from this that the conduction of III_- and of the three transistors are related. Written as a formula, it is

$$I = \frac{\alpha_1 \alpha_3 I_G}{1 - (\alpha_1 + \alpha_2)}$$

The denominator should also have the term $\alpha_1\alpha_3$, but because it is smaller than α_1 and α_2, it can be omitted. The above discussion shows that transverse resistance R is closely related to the strength of the III_- triggering current. This determines the large influence of the position of the N_4 region below the gate upon the triggering current.

The III_+ triggering method is similar, and will not be repeated here.

The above discussions neglected the short-circuit current between T_2 and G from P to P. Regardless of the triggering method, part of the triggering current flows into the short circuit. In manufacturing, this part of the current is exactly one of the versatile parameters which can be changed at will in the design, and it benefits the symmetry of adjusting the four methods of triggering.

Diagram 5 Structure and conduction mechanism of the bidirectional thyratron transistor

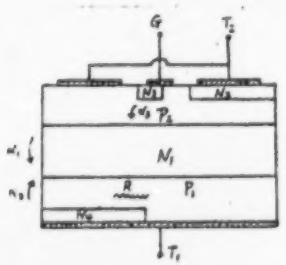


图 5 .双向晶闸管结构及导通机理

3. Manufacture

The manufacture of the bidirectional thyratron transistor and the manufacture of ordinary thyratron transistors are similar in many aspects. The main differences are:

(1) The summetry of the four types of triggering methods must be good. There are many controllable factors in this regard--for example, the amplification coefficients of each transistor, the short-circuit current, the transverse electrical resistance, etc.

(2) Double-surface photoetching must be accurate. This has a definite effect upon the ability of directional change and the triggering current.

(3) Ohm contact: The Ohm contact on the anode T_1 surface is a special problem, because the T_1 surface includes the N region and the P region. To realize a good Ohm contact and avoid damaging the performance of the shallow node, the methods of solving the problem in the large-power bidirectional thyratron transistor and the small-power bidirectional thyratron transistor are not completely the same.

(4) Surface protection, especially the difficulty in retaining voltage after cutting the chips, is a problem. There are definite difficulties in using purely planar technology to reach a high voltage. Glass inactivation is a method. The heat-migration technique also has its advantages.

4. Application

Table 2 gives the simplest form of control of the power of an alternating current of Diac. But when this circuit is used to adjust light, the problem of lagging and jumps cannot be neglected.

Lagging means that when R_H increased to R_{H2}, the bidirectional thyratron transistor is no longer triggered; i.e., $i_L = 0$. Yet when R_H reduces, retriggering the bidirectional thyratron transistor is not possible at $R = R_{H2}$. It must drop to R_{H1} before the component begins conducting. Therefore, between R_{H1} and R_{H2} exists a dual value zone of a different conducting angle. It corresponds to the $i_L = 0$ state and also coresponds to the state in which i_L is not equal to 0. $\Delta R_H = R_{H2} - R_{H1}$ indicates the degree of lag.

Diagram 6 Lagging and jumping phenomena

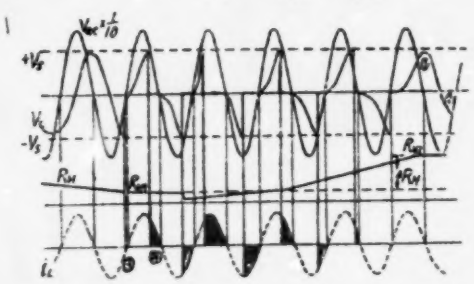


图 6 .滞后及突跳现象

The cause of the lag can also be explained by Diagram 6. When R_H increases to R_{H2}, (See Diagram 6 (1)), it immediately drops by a half-wave. The Vc on the capacitor becomes still smaller than the turning voltage Vs of Diac (See Diagram 6 (2)). Afterward, if R_H does not change, this level will be maintained. We must reduce R_H to cause Vc to rise. When it drops to R_{H1}, Vc will be able to rise to Vs, Diac turns, and the bidirectional thyratron transistor begins conducting. This is the reason that R_{H2} lags to R_{H1}.

Jumping means that when R_H drops to R_{H1} (See Diagram 6 (3)), the next half-wave Vc rapidly rises and moves the conduction angle forward by a large scale. This is a jump. In light regulation, if we begin regulation from complete darkness, the device will not gradually adjust from complete darkness to brightness but will suddenly jump from complete darkness to definite brightness. Of course, this is not desired. The cause of the sudden jumps is also the result of remnant voltage on the capacitor.

For this reason, people have reduced the lag from two approaches. One is to introduce a new triggering device, which will be discussed in the next section. The other method is to improve the circuit--for example, by using the circuit shown in Diagram 7. It is more complex than the circuit listed in Table 2, but C_2 can be utilized to charge C_1 so that after C_1 discharges, a relatively high Vc can be maintained, thus reducing the lag. (The Vc in Diagram 6 (2) is maintained at the level of (1) so that the Vc in (4) approaches the level of (3).)

Diagram 7 Triggering circuit that reduces lagging

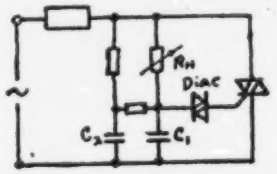
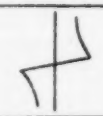
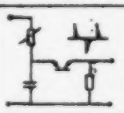
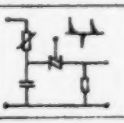
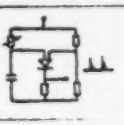


图 7 .减小滞后现象的触发电路

Table 2 Characteristics and Triggering Circuits of the Various Triggering Devices

表二、各种触发器件的特性及触发电路

(1) 器件	(2) 特性	(3) 电路	V_s	i_p	t_{on}
Diac			15~36 V	1~2 A	1 μs
SBS			6~10 V	2A	1 μs
PUT			$\frac{R_1 V_B}{R_1+R_2}$	2A	80 ns

Key:

1. Device
2. Characteristics
3. Circuits

III. Introduction to Several Major Types of Triggers

Triggering devices are a big family. They include the following devices:

(1) Unijunction transistors

Unijunction transistors (UJT), complementary unijunction transistors (CUJT), process control unijunction transistors (PUT), equivalent unijunction transistors (EUJT).

(2) Three-layer devices

Bidirectional triggering diode (Diac).

(3) Four-layer devices

Four-layer diodes (FLD, Shockley diode), silicon unidirectional switch (SUS), silicon-controlled switch (SCS).

(4) Five-layer devices

Silicon bidirectional switches (SBS), symmetric silicon switches (SSS) for triggering, asymmetric silicon bidirectional switches (ASBS).

(5) Triggering integrated circuits

Phase-controlled triggering circuits, over-zero triggering circuits, interference-proof triggering circuits.

The above classification is not very exact, because in unijunction transistors, only UJT is truly a unijunction transistor. CJUT is a thyratron transistor with two resistors added; PUT is an N gate thyratron transistor; and EUJT is an integrated circuit consisting of a PUT and transistors.

Similarly, although SUS is a four-layer device, it also has a voltage stabilizer in series. SBS is a five-layer device connected to two voltage stabilizers in series. ASBS is an SBS with a voltage stabilizer connected in series.

This article will give only a brief introduction to these three major types of triggers. We can refer to Table 2. These are also triggering devices which our nation should develop first (UJT has already been produced domestically).

1. Diac

Diac is one of the most common triggering devices. It is actually a symmatric transistor with a basic pole open circuit. Therefore it is the simplest to manufacture. Of course, some difficulties exist and they have to be overcome.

As Table 2 shows: When the turning voltage Vs is reached, negative resistance is produced. This is because the electrons accumulate inside the base region and cancel the blocking layer. It is also the result of $\alpha M = 1$; the larger the α, the larger the negative resistance.

The circuit should be improved as illustrated in Diagram 7 when Diac is used for regulating light.

2. PUT

PUT is a type of N gate thyratron transistor. It can be used as a unijunction transistor, and it can also be used as a small thyratron transistor; it is a thyratron transistor that is especially sensitive to triggering. This is because the controlling current from the gate to the cathode always flows in a longitudinal direction.

PUT can be made in a transverse or a longitudinal structure. If another electrode is extended from the P base region of a PUT, it actually becomes an SCS.

When a PUT is used as a unijunction transistor, it must be fitted with an electrical resistor, as shown in Table 2. Because the electrical resistance can be changed at will, the required Vs, the peak current I_P and the trough current I_V can be designed. The process-control unijunction transistor gets its name "process control" from this.

PUT is a direct current device.

3. SBS

SBS is actually a planar transverse bidirectional thyratron transistor. Because it is connected to two voltage stabilizers in series, its voltage is determined by the voltage stabilizer, and the voltage is lower.

When using the SBS triggering circuit, the SBS gate can be utilized to trigger the SBS. Therefore the remanant voltage on the capacitor can be completely drained, thus eliminating the lagging effect.

The manufacturing technology of SBS is similar to that of the PUT transverse structure. Because it is of a planar structure, its voltage characteristics are easily obtained. The other major characteristics are similar to those of PUT, but it is a bidirectional device.

At present there are more production plants, and it is completely possible to produce the various types of triggers described above by a division of labor. But popularizing a new device requires the coordination of many circuits. The triggering integrated circuit should also be developed. In particular, the over-zero triggering circuit is very useful for solid-state relays.

In the push to develop electrical appliances for everyday use, the various types of electrical semiconductor devices have undergone new development. At this time, we should strengthen leadership and organization and strengthen cooperation and exchanges in order to make new contributions to the development of our nation's electrical and electronic technology.

FOOTNOTES

1. Futaro Kotsuai: Fundamentals and Application of the Thyristor, 1978.

2. Application of the Thyristor, Maruzen Company, 1974. Refer to "Translations of Articles on Electricity and Electronics", Nos 3-4, 1980, FOREIGN ELECTRICAL AND ELECTRONICS TECHNOLOGY," No 1, 1981.

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5. Zhang Weizuo [1728 3634 0146]: "Principles and Applications of New Types of Electrical Semiconductor Devices", Machinery Industry Press, 1982.3

9296
CSO: 4008/111

COMPUTER USED FOR CONSTRUCTION PROJECTS IN CHANGZHOU

Nanjing XINHUA RIBAO in Chinese 24 Jan 82 p 1

[Article by Ju Zhenqiu [1446 7201 3808]: "The 'Electronic Brain' Enters the Building Industry"]

[Text] Starting 1 January, the small electronic computer, which people call an "electronic brain", has begun to replace preliminary accounting personnel in some units of the Changzhou municipal construction and engineering system to carry out the task of compiling preliminary accounts for civil engineering projects. This new achievement in scientific research is a welcome step toward the gradual realization of modernization in technology and management in construction enterprises.

This small electronic computer for use in the construction industry was successfully developed by the Fourth Engineering Department of the Changzhou Municipal Construction Engineering Bureau, in cooperation with the Second Changzhou Radio Plant. They spent 11 months and conducted several hundred tests. This computer is small, lightweight, has a low construction cost, computes accurately, and has a stable performance. On 26 and 27 December last year, it passed evaluation [tests] and received praise. This computer can compile and print one preliminary account in half an hour including complete data on the code number of the project, the area of building, building costs, the amount of work, and the consumption of materials. It saves three-fourths the time required manually, and it has shortened the compilation period. At the same time, the computer's data are accurate, it avoids the errors and mistakes of manual calculations, and it improves work efficiency.

At present, the First, Fourth and Sixth Departments of the Changzhou Municipal Construction Engineering Bureau, the Changzhou Municipal Building Design Office, and the Changhzou Residential Housing Company have begun using this computer to compile preliminary accounting data for construction projects.

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CSO: 4008/101

USE OF PORTABLE TI-59 COMPUTER BEING POPULARIZED

Beijing SHUILI SHUIDIAN JISHU [WATER CONSERVATION AND HYDROELECTRIC POWER TECHNOLOGY] in Chinese No 1, 1982 p 65

[Article provided by Yuan Tanlin [5913 2905 2651]: "Popularization and Use of the TI-59 Computer in Hydraulic Engineering Design"]

[Text] In recent years, the programmable TI-59 computer introduced into our nation is being used more widely and has been welcomed. The computer is a portable, handheld computer. Its functions are between those of a computer and those of a function calculator. Relatively long programs can be compiled, and the computer is fitted with a program library composed of large-scale integrated circuits. It can perform some of the functions of a small computer.

To study the possibility of using that computer in hydraulic engineering design, the Planning and Design Management Bureau of the Ministry of Water Conservancy held a short computer training class for the hydraulic engineering profession in Beijing from 5 to 15 December 1981. Fifty students from the water-conservancy and hydroelectric design units subordinate to the ministry and of 26 provinces and cities participated in the training class. Professor Zhen Fengshi [6774 6646 2514] of Qinghua University and eingeer Guan Yinghua [7070 5391 5478] of the Beijing Survey and Design Academy of the Ministry of Water Conservancy taught the use of the computer, techniques for compiling programs, and methods of compiling applications programs for hydraulic engineering. During this brief learning period, the students compiled on a trial basis more than 30 types of programs, including programs for antislippage stabilization of the whole equal K body of the dam shoulder of an arch dam, antislippage stabilization of a gravity dam, programs for the slipping arc of the slope of an earth dam, waterjump, water surface lines of exposed canals, seepage, and stress calculations for photo-elasticity tests. They expressed their belief that as long as forces are organized to compile general-purpose programs, many regular methods of standard computation in hydraulic engineering design can all be done by programmed computations on the TI-59 computer. This computer is more suitable for repeated computations and for trial-and-error calculations in solving equations of implicit functions.

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CSO: 4008/101

HEILONGJIANG HOLDS COMMUNICATIONS WORK CONFERENCE

SK231213 Harbin Heilongjiang Provincial Service in Mandarin 1100 GMT 22 Apr 82

[Excerpts] The provincial post and telecommunications work conference concluded today. Chen Lei, secretary of the provincial CCP committee and provincial governor, addressed the conference. He pointed out: accelerating post and telecommunications construction, strengthening the capacity of communications, easing the strained situation in communications, improving the service and quality of this work and raising economic results are tasks of top priority in post and telecommunications construction.

Chen Lei said: In carrying out current post and telecommunications work, we must pay attention to some key points. First, we must install local telephones in large and medium-sized cities and in industrial and mining areas; second, we must grasp well communications work in the border areas. All planning and construction departments of large and medium-sized cities must bring the plans of installing local telephones and establishing post and telecommunications service network into line with the urban construction plan.

While addressing the issue of improving post and telecommunications service and improving quality and economic results, Chen Lei stressed: post and telecommunications are matters concerning the welfare of each and every family. Their purpose is to serve society as a whole and to keep in touch with the people and the masses. Post and telecommunications departments and personnel concerned must foster the idea of serving the people and being responsible for the users, regard the degree of satisfying the needs of society as the highest standard for examining post and telecommunications service work, resolutely overcome the Yamen work style and launch service activities aimed at treating people politely, providing good service, giving convenience to the masses and safeguarding the departments' reputation. In addition, departments concerned must also overcome conservative ideas and actively carry out all kinds of post and telecommunications businesses that are urgently needed in society and provide good economic results.

CSO: 4008/164

OPTICAL FIBER MANUFACTURING TECHNIQUE DESCRIBED

Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese No 1, 1982 pp 33-38

[Article by Teng Yucai [6772 6757 2088], Luo Huiying [5012 1979 5391], Wang Yanfang [3769 5333 5364], Xiong Jiancun [3574 1696 4783], and Wang Shubin [3769 3219 2430] of the Wuhan Postal and Telecommunications Science Research Institute: "Using the Microwave Plasma Activated Chemical Vapor Deposition Method to Prepare Low-Loss Optical Fibers"; article received by this journal on 10 August 1981]

[Text] This article describes the basic principles and the main characteristics of the equipment developed for the microwave plasma-activated chemical vapor deposition method. At the same time, it describes the basic data on using this method to prepare optical fibers drawn from preforms. The multimode step index optical fiber presently prepared has a loss reaching 5 dB/km (at a wavelength of 0.85 μm). The lowest loss is 2.84 dB/km (at a wavelength of 1.07 μm). The efficiency of deposition of the raw material has already surpassed 90 percent.

I. Introduction

The optical communications fibers presently in use are mostly quartz fibers prepared by the chemical vapor deposition method (abbreviated the CVD method). The manufacturing techniques can generally be divided into the outside vapor phase oxidation technique (OVPO) and the inside vapor phase oxidation technique (IVPO). The former includes the outside vapor phase deposition method (abbreviated the OVD method) and the vapor phase axial deposition method (abbreviated the VAD method). The latter includes the modified chemical vapor phase deposition method (abbreviated the MCVD method). This article discusses the microwave plasma activated chemical vapor phase deposition method (abbreviated the PCVD method).

The outside vapor phase oxidation technique is complex. Under ordinary conditions, it does not easily produce high-quality optical fibers. In the inside vapor phase oxidation technique, the reaction occurs inside a tube; therefore, it is easier to avoid pollution by the outside environment, and

low-loss optical fiber can be produced. In the MCVD method, oxyhydrogen flame is used as the heating source. The procedure is simple, and so this method is mostly used domestically.

In the MCVD method, because the deposition temperature reaches as high as 1400° C to 1600° C, the vapor phase reaction first forms an oxidized dust, and then the dust is melted. The core layer generally can only deposit about 60 layers of variable concentrations of a nearly ideally distributed refractive index. Therefore, control over this method is more difficult. Consistency is poor, the bandwidth characteristics are not good enough, and the deposition efficiency is low (generally 15 to 30 percent).

The PCVD method 1 has these major advantages over other methods: it does not use oxyhydrogen flame for heating. The deposition temperature is only about 100° C. Control is good. Thickness of the deposited layers can be smaller than 1 μm. The core layer of the optical fiber can deposit up to 1,000 layers of variable concentrations of a nearly ideally distributed refractive index. The optical fiber has good geometric and optical characteristics. In particular, the bandwidth is wider and repeatability is good. The deposition efficiency is high, approaching 100 percent.

Current reports indicate the high-quality multimode gradient fibers have been produced 2. It is expected that this will also demonstrate its unique advantages in preparing single-mode optical fibers.

This article mainly describes the fundamental principles and the major characteristics of the equipment developed for the PCVD method. At the same time, it describes the basic data for preparing optical fibers drawn from preforms using this method. The loss of the multimode step index optical fiber currently prepared is 5 dB/km (at a wavelength of 0.85 μm); the lowest loss is 2.84 dB/km (at a wavelength of 1.07 μm); and the deposition efficiency can reach a high of over 90 percent.

II. Basic Principles

The major characteristics of the PCVD method is the use of nonisothermal plasma (also called cold plasma) as the reaction source, as shown in Diagram 1. When highly pure hilades $SiCl_4$ and $GeCl_4$ are carried into the reaction tube by carrier O_2, they enter the strong electrical field region of the resonance cavity. The raw material gas is excited and ionized, maintains a glow discharge, and forms a nonisothermal plasma. The neutral molecules of the various raw materials are ionized to become charged particles (electrons, cations, anions) and charge-free particles (atoms of the gas, molecules, excited atoms, semi-stable atoms). The silicon and oxygen combine to form SiO_2. It deposits, via expansion, on the inner surface of the reaction tube. This is a type of chemical effect of microwave discharge.

The main characteristic of the PCVD method is that its reaction temperature is lower than the corresponding temperature of heated reactions. This brings about a series of advantages in preparing optical fibers.

Because ionization of gas is not limited by the thermal capacity of the reaction tube, the resonance cavity can move back and forth quickly along the reaction tube. Thus up to 1,000 layers of extremely even, transparent, thin layers can be prepared. Because there is no pulverization process, the deposition efficiency is high.

The temperature of the preheating furnace surrounding the reaction tube is about 1100° C. Its function is to maintain matching temperatures between the inner wall of the reaction tube and the depositing layers so as to avoid cracking in the depositing layers and at the same time to reduce the chlorine content in the bubbles produced in the depositing layers.

The PCVD method prepares optical fibers generally in three stages: the first stage is to deposit the core layer inside the reaction tube (the final layer becomes the wra-ping of the optical fiber). The second stage is to heat the layers with an oxyhydrogen flame to 1900° C - 2000° C and condense them by melting into a solid rod of the "preform." The third stage is to use the graphite furnace to reheat the preform to about 2000° C and then draw the rod into optical fibers.

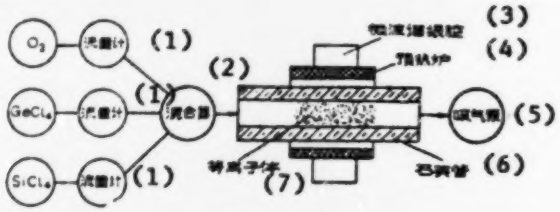

图 1 PCVD 法原理图

Diagram 1. Illustration of the principles of the PCVD method

Key:

1. Fluviometer
2. Mixer
3. Microwave resonance cavity
4. Preheating furnace
5. Sunction pump
6. Quartz tube
7. Plasma

III. Experimental Equipment

The PCVD equipment we developed mainly consists of the following four parts as shown in Diagram 2.

1. Microwave System

The microwave system consists of a continuous-wave magnetic control tube with an operating frequency of 2450 MHz and a maximum output of 150 W, a plasma resonance cavity, and corresponding waveguide elements.

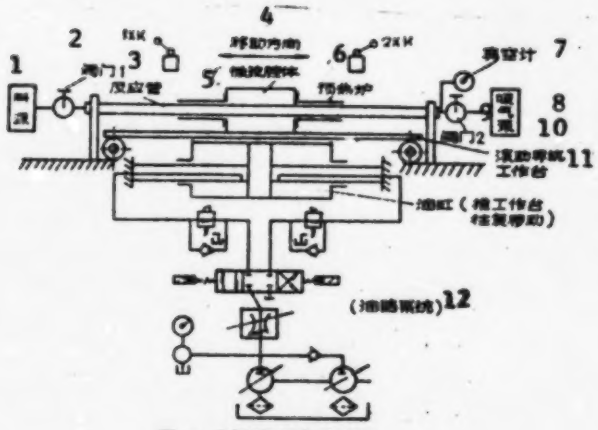

图 2 PCVD 设备示意图

Diagram 2. Illustration of PCVD ewuipment

Key:

1. Material source
2. Valve 1
3. Reactor tube
4. Direction of movement
5. Microwave cavity
6. Preheating furnace
7. Vacuum gauge
8. Suction pump
9. Valve 2
10. Roller guide rails of the work platform
11. Fuel tank (for moving the work (platform back and forth)
12. (Fuel pipe system)

According to technological requirements, a reentry resonance cavity is more suitable. The reentry cavity we developed uses ring coupled input. Under actual experimental conditions (with an operating pressure of 5 torr, and input power of 150 W), glow discharge can be produced without using the Tesla coil for excitation. The maximum volume of the plasma produced can surpass 20 cm^3. The longest plasma column can surpass 20 cm, completely satisfying the requirements of the PCVD method 3.

The connection between the nicrowave cavity and the magnetic control rube is a 30 dB directional coupler serving as a power monitor, and 50Ω coaxial wires are used to connect the N joints, as shown in Diagram 3.

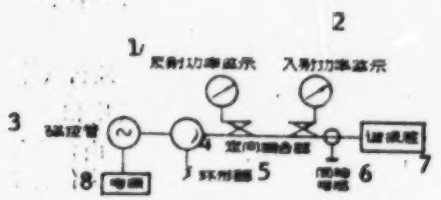

图 3 微波系统原理示意图

Diagram 3. Illustration of the principles of the microwave system

Key:

1. Reflected power monitor
2. Incident power monitor
3. Magnetic control tube
4. Ring
5. Directional coupler
6. Coaxial electric cable
7. Resonance cavity
8. Power source

2. The Vapor System

In front of the reaction tube are various raw materials ($SiCl_4$ $GeCl_4$, O_2) and corresponding fluviometers, a bulging bubble flask, and a mixer. To prevent impurities in the air from entering the system, a working state slightly more positive than the atmospheric pressure is maintained in front of valve 1. At the end of the reaction tube is a suction pump and a vacuum gage. By adjusting valve 2, a working pressure of 1 to 30 torr can be maintained inside the reaction tube.

3. The Reactor

This consists mainly of a reaction tube, a resonance cavity, and a preheating furnace. The reaction tube is stationary. It is a quartz tube with an outer diameter of 10 mm and an inner diameter of 8 mm. A water-cooled resonance cavity and a preheating furnace are installed together, and they can move back and forth.

4. Smelting Lathe

To realize back-and-forth movement in a straight line with stepless speed regulation along the distance L = 0 to 80 cm, a hydraulic transmission lathe is used. Its advantages are as follows: it is easy to realize back-and-forth movement in a straight line to directly drive the operating mechanism. It can perform stepless speed regulation within a relatively large range. The motion of transmission is smooth and steady and maintains an even speed, which enables the thickness of the deposits to be even. It is easy to realize automatic transmission and control. The structure and circuitry of the mechanism are simple, and its useful life is long.

The distance of the work platform of the smelting lathe L = 0 to 80 cm is continuously adjustable. The speed of motion is V = 0.4 to 20 m/min with

stepless speed regulation. The variation in speed is no larger than 20 percent, and the rise in temperature is smaller than 10° C.

IV. Results of Deposition Experiments and Discussion

1. Stationary Experiment

The resonance cavity and the reaction tube are stationary, mainly to study the deposition of pure SiO_2.

The raw materials are $SiCl_4$ and O_2. Reaction under room temperature produces SiO_2, deposits, but there are large areas of cracks, and the layers shed easily after a certain thickness has been reached. This is caused mainly by the temperature of the wall of the reaction tube being too low and by its not matching the temperature of the deposits. Stress appears, and the chlorine content in the deposit becomes too high. When the temperature of the preheating furnace is raised to over 800° C, highly even and transparent SiO_2 deposits are produced.

The plasma column is basically symmetrical to the center of the cavity. The greater the input power or the lower the working pressure, the longer the plasma column. The main portion of deposition does not occur at the center of the cavity but several centimeters away from the center of the cavity, toward the vapor intake end. This is because, when raw material gases enter the plasma column, chemical reaction begins and deposits begin. The length of the deposits and the deposition efficiency are determined mainly by the velocity of the flow V_m of the raw material gas inside the reaction tube. The velocity of flow V_m can be given by the following formula:

$$V_m = Q/\pi \cdot r^2 \cdot p' \qquad (1)$$

where Q is the value of total flow.

p' is the ratio between the working pressure and the atmospheric pressure.

4 is the inner radius of the reaction tube.

When V_m equals several hundred meters per minute, the raw material gas stays in the plasma column for several dozen milliseconds, and a realtively short deposition length of 1 to 2 cm can be obtained, with a relatively high deposition efficiency of over 90 percent.

Deposition efficiency η defined as

$$\eta = \frac{\text{Weight of deposits of oxides from converted hilades}}{\text{Weight of deposits of oxides from complete coversion of hilades}} \qquad (2)$$

The experimental results of the deposition efficiency of SiO_2 are shown in Diagram 4. The solid line in the diagram represents the theoretical value of η = 100 percent. It is calculated from the equation of the chemical reaction.

It can be seen from the diagram that the highest η is about 95 percent, and it is generally near 80 percent. It can be seen from the experimental results with these basically similar conditions that the larger the Q (i.e., the larger the consumption of $SiCl_4$), the lower the η (as shown by the dotted lines in Diagram 4). This was caused mainly by an overly large velocity of flow V_m. It was also discovered that the exit of the flask containing the raw material gas had been leaking. This was another reason why the experimental value of η was low.

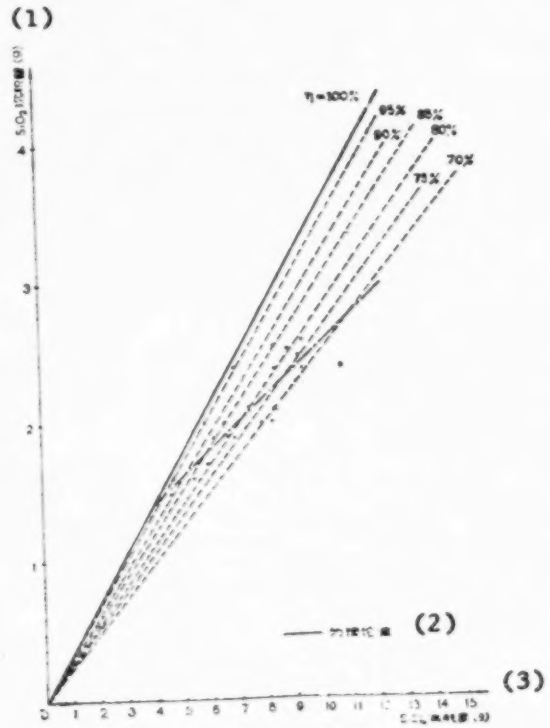

Diagram 4. Theoretical and experimental values of the deposition efficiency

Key:

1. Amount of deposits
2. Theoretical values
3. Consumption

2. Dynamic Experiment

As the resonance cavity moves back and forth relative to the reaction tube, even, transparent, and thin layers deposit along the inner wall of the reaction tube. We discovered that when the temperature in the preheating furnace was bout 1000° C, large air bubbles emerged in the depositing layers during the melting and condensation stage, even though the depositing layers were still transparent. When the temperature of the preheating furnace was above 1100° C, this phenomenon was eliminated. According to analysis using the method of neutron excitation by Kuppers, et al, we know that the chlorine content in the depositing layers drops as the temperature of the preheating furnace rises. For example, at 980° C, the chlorine content drops as the temperature of the preheating furnace rises. For example, at 980° C, the chlorine content increases to 1 wt %, while at 1050° C its content is only 0.1 wt % 4. The main cause of the occurrence of air bubbles is the release of chlorine under high temperatures.

The experiments of mixing impurities (GeO_2, P_2O_5, B_2O_3) in SiO_2 all produced satisfactory results.

Experiments were conducted to examine the ratio of the refractive index and the amount of flow of the carrier gas of SiO_2 glass after mixing in Ge. If the amount of the impurities mixed into the glass is small, the ratio between the variation of the refractive index caused by the mixing of impurities and the amount of impurities can be considered directly proportional 5. The experimental results are shown in Diagram 5.

In the diagram, "." [the dots] are the test results. Their deviation from the straight line, according to analysis, is due mainly to poor precision of the fluviometer and different levels of the surface of the liquid in the material supply flask during each experiment.

3. Preparation of the Multimode Step Index Optical Fiber

The PCVD method for preparing multimode gradient optical fibers has its unique advantages. Because of a lack of corresponding flow-control equipment at present, only research in the preparation of the step index optical fiber has been conducted. The optical fiber has a structure that is illustrated in Diagram 6.

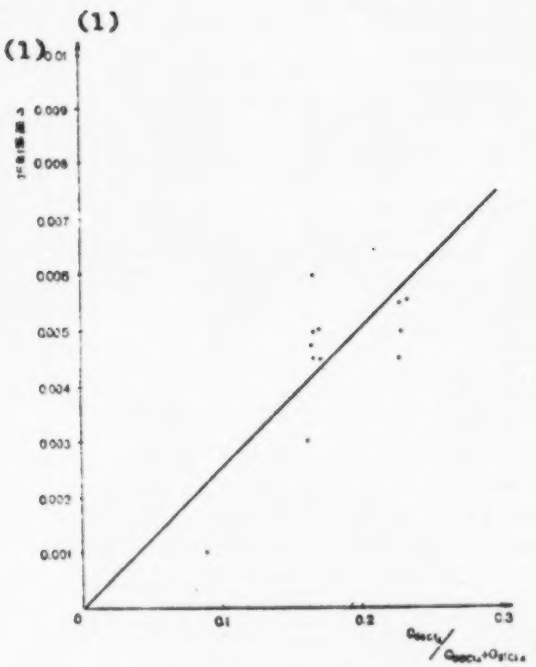

Diagram 5. The ratio between the difference in the refractive indices and the amount of flow of the carrier gas.

Key:

1. Difference in refractive indices

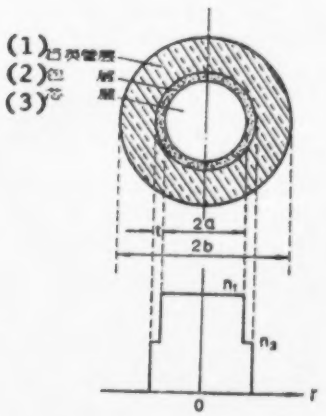

Diagram 6. Structure of the optical fiber: Outer diameter is 2b; diameter of the core is 2a; refractive index is n_1; thickness of the wrapping layer is t; refractive index is n_2.

$$\Delta = \frac{n_1 - n_2}{n_1} .$$

Here, t is the wrapping layer formed by the highly pure glass deposits. It serves to reduce the added loss in the percolation field in the core, to block any thermal expansion of the transient metallic ions and OH^- ions toward the core in the quartz tube, and to improve the loss characteristics of the optical fiber. Combining the various considerations, we can generally determine the structure of the optical fiber as follows:

At λ = 0.8 μm, Δ = 1 - 0.7 percent, 2b = 125 μm, 2a = 50 μm, t = 10 - 15 μm.

Wrapping layer material: pure SiO_2 glass structure.

Core layer material: SiO_2 - GeO_2 binary system glass structure.

Raw materials: O_2 is at the electron level; the purity of $SiCl_4$ and $GeCl_4$ is 99.9999%; the quartz reaction tube is a second-grade electrofusion tube.

The typical data of deposition are Q_{O_2} = 10 - 20 ml/min, Q = 50 ml/min, Q_{GeCl_4} - 15 ml/min. The working pressure is P = 8 ~ 10 torr. The temperature of the preheating furnace is T_f = 1150° C. The microwave input power is P = 150 W. The cavity traveling speed is V = 2.4 m/min. The distance of travel is L = 20 cm. The number of deposited wrapping layers is about 700 layers, and the deposited core layers number about 1,000 layers.

After deposition, the tube is melted and condensed over an oxyhydrogen flame to a solid rod of an outer diameter of about 7 mm and a length of about 20 cm. Finally, the rod is drawn in a graphite furnace into an optical fiber about 500 m long.

The above method was used to prepare some optical fibers. The best fiber among them has been analyzed as follows:

The distribution of the refraction index of the fiber was tested. The outer diameter of the fiber was 125 μm. The diameter of the core was 44 to 48 μm, N · A = 0.16, and the core had an ellipticity of 2 percent. This is because, during the melting and condensation stage, positive pressure was not added inside the tube and contraction was uneven.

The cutting method was used to measure the loss. At a wavelength of 0.85 μm, the loss was 4.3 dB/km. The curve of the optical spectrum of the loss is shown in Diagram 7: Within the range from 0.8 to 0.87 μm, the loss was about 5 dB, basically consistent with the results obtained by the cutting method. The loss at the absorption peak of the OH^- harmonic on the 0.95 μm wavelength reached a high of 54 dB/km. This was due to pollution by over 50 ppm of OH^-. According to analysis, this was caused mainly by imperfections in the system of vapor channels. If OH^- pollution is reduced, the loss over the entire wave segment can be expected to drop by a relatively large scale. At 1.07 μm wavelength, the least loss was 2.84 dB/km.

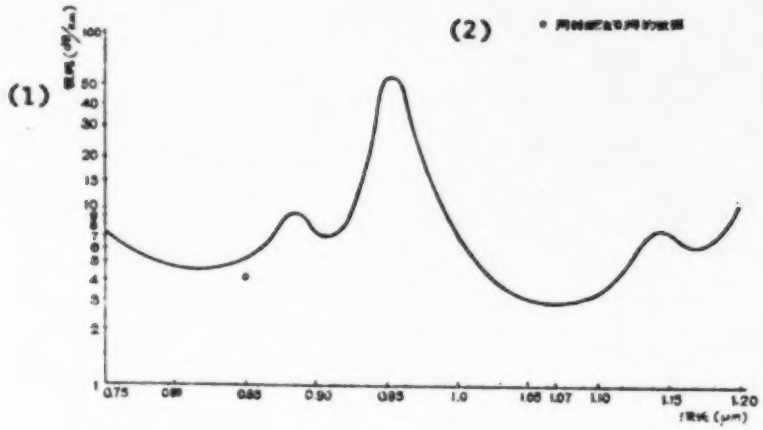

Diagram 7. The curve of the optical spectrum of attenuation and loss of a GeO_2 - SiO_2 optical fiber.

Key:

1. Attenuation and loss
2. Data measured by the cutting method

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9296
CSO: 4008/108

BRIEFS

MAGNETIC RECORDING TECHNOLOGY--Lanzhou, 23 Apr (XINHUA)--The hot-pressed ferrite material used in magnetic recording heads, developed by Lanzhou University, northwest China, has reached advanced world level in major technological norms according to appraisals by the Ministry of Education. Five types of hot-pressed ferrite materials have been developed in recent years by the university's magnetism laboratory, led by associate Professor Yang Zhen, vice chairman of the Society of Applied Magnetism under the Chinese Institute of Electronics. The material for making magnetic heads is essential for developing magnetic recording technology, which is widely used in industry, agriculture, scientific research and education. The technology has a high recording density, costs little and preserves recorded messages for a long time. [Text] [OW251341 Beijing XINHUA in English 0737 GMT 23 Apr 82 OW]

HEILONGJIANG MICROWAVE-CIRCUIT DIALING--Beginning on 21 April, Harbin, Qiqihar, Mudanjiang and Daqing municipalities, Heilongjiang Province, opened the microwave-circuit long-distance dialing service to places throughout the country. [Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 21 Apr 82 SK]

CSO: 4008/164

HUNAN HOSTS NATIONAL CHINESE MEDICINE CONFERENCE

HK240244 Changsha Hunan Provincial Service in Mandarin 2310 GMT 23 Apr 82

[Text] A national Chinese medicine work conference concluded in Hengyang on 22 April. The conference proposed: Chinese medicine hospitals and institutes of higher education must give further prominence to the characteristics of Chinese medicine, bring into play its superior features, and strive to medical studies, so as to make contributions to people's health and socialist modernization.

Chinese medicine has recorded notable achievements since the third plenary session, because the leaders at all levels have attached importance to it. The Chinese medicine organs have been revived and developed. Leaders and public health administrative departments at all levels have paid attention to the role of Chinese medicine in keeping the people healthy, and have shown great concern and provided great support for it.

During the conference, representatives of Shaanxi, Jiangsu and Hubei Provinces, Jinzhou Municipality in Liaoning, the Hunan Provincial Public Health Department, and Hengyang Prefectural Public Health Bureau introduced their experience in mobilizing the enthusiasm of all quarters and supporting the development of Chinese medicine hospitals.

The participants held discussions on the question of how to maintain the characteristics of Chinese medicine and run the Chinese medicine hospitals well. The chinese medicine hospitals including those in Wuhan and Hengyang Municipalities have applied Chinese medicine theory to guide their diagnosis and treatment work and maintained the orientation of applying the characteristics of Chinese medicine to run the hospitals. The conference praised their experiences.

The Hunan Provincial Public Health Department simultaneously held a provincial conference on Chinese medicine work. The representatives attending these two conferences visited Chinese medicine hospitals in Hengdong, Qidong, Qiyang and Hengyang.

CSO: 4008/163

BRIEFS

MEDICAL WORK IN THIRD WORLD--Beijing, 16 April XINHUA LAA Chinese medical teams have treated more than 52 million patients in West Asia and Africa in the past 19 years, according to a meeting yesterday of the medical and public health section of the national committee of the Chinese people's political consultative conference. Xue Gongchuo, director of the foreign affairs bureau of the Ministry of Public Health, described China's medical work abroad. He said 34 teams staffed by 1,075 medical workers have been working in West Asia and Africa since 1963. Teams have been sent to 41 countries and regions, rendering both treatment and training to a great number of personnel in the third world. Members of the C.P.P.C.C. national committee attending the meeting said it is very important for China to send medical teams to the third world, promoting a link between the Chinese people and those in the third world. Efforts should be made to strengthen and improve the work, they said. [Text] [OW162212 Beijing XINHUA in English 1618 GMT 16 Apr 82]

CSO: 4008/163

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[Text] Ellipsoidal Thin Shell Based on the Elasticity of Axial Tube Bundle.....Chen Guodong [7115 0948 2767], Tianjin Paint Plant (1)

The Investigation of Spheroidal Graphite in Iron-Carbon Alloy .....Chen Xichen [7115 3356 3819], Wang Zulun [3769 4371 0178] and Yi Sunsheng [2496 1327 5110], et al., all of the Institute of Physics, Chinese Academy of Sciences (15)

The Investigation of Fatigue Crack Initiation and Propagation Mechanism for Nodular Cast Iron.....Hu Zhizhong [5170 1807 1813], Guo Dazhan [6753 1129 1455] and Zhang Pingsheng [1728 1627 3932], et al., all of the Strength Research Institute, Xi'an Jiaotong University (25)

Extra-fine Metal-cutting for High-Phosphorus Cast Iron..... Chen Yueyao [7115 2574 2565] and Lu Wenxiang [4151 2429 4382], both of Huazhong Institute of Technology (33)

Exploration of the New Process of Making Large Bevel Gears with Straight Teeth.....Zhu Jingzi [2612 2529 2737] and Cheng Naishi [4453 0035 1102], both of Taiyuan Institute of Technology (42)

The Copying Cam Computation of Stator Curve of Radial Hydraulic Motor.....Jian Wanliang [5054 8001 0081], Construction Machinery Research Institute (52)

A Calculation Formula for Carrying-capacity of Annular Hydrostatic Steep-bearing Taking Account of Oil-flow Inertia..... Chang Jinshi [1603 6602 2514], Huadong Water Conservancy and Hydroelectric College (62)

Optimal Dynamics of Axis-system.....Lin Jiahao [2651 1367 3185], Engineering Mechanics Research Institute, Dalian Institute of Technology (69)

An Investigation of the Determination of Metal Surface Stress in Depth Profile by a New Nondestructive Method .....Yang Yuxing [2799 0060 5281], Department of Metal Materials Engineering, Shanghai Jiaotong University (79)

The General Methods for Finding the Natural Frequencies and the Steady State Response for the Straight-through Systems.....Zheng Zhonghao [6774 0112 4108], Zhongnan Mining and Metallurgy College (88)

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CSO: 4008/149

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[Text] General Solution for Elastic Pile and Elastic Beam .....Zhou Ming [0719 6900], East China College of Hydraulic Engineering, Nanjing (1)

State-of-the-art of Dynamic Characteristics of Soil under Ocean Wave Loading.....Qian Shouyi [6929 1108 2496], Lou Zhigang [2869 1807 0474] and Du Jinsheng [2629 6855 5116], all of the Institute of Mechanics, Chinese Academy of Sciences, Beijing (16)

On the Calculating of Earth Pressure Acting on Counterfort Structure.....Mai Yuanjian [7796 6678 0313], Research Institute, Fourth Bureau of Navigation Engineering, Ministry of Communication, Guangzhou (24)

Mechanical Characteristics of Under-consolidated Clay Soils with Structural Strength.....Li Zuoqin [2621 0155 0530], Institute of Rock and Soil Mechanics, Chinese Academy of Sciences, Wuhan (34)

Nonlinear Analysis of Soils Using the Cubic and Bicubic Spline Function.....Lu Peiyan [7120 1014 3508], Xiong Lizhen [3574 7787 3791], Chen Shaoyong [7115 7300 3057] and Chen Mingqing [7115 0682 0615],all of the Scientific Research Institute of Water Conservancy and Hydroelectricity of Guangdong Province, Guangzhou (46)

Probabilistic Approach to Settlement Prediction of Sandy Stratum.....Sheng Chongwen [4141 1504 2429], Nanjing Hydraulic Research Institute (63)

On the Mechanism and Process of Slope Deformation in an Open Pit Mine.....Wang Sijing [3769 1835 2417], Institute of Geology, Chinese Academy of Sciences, Beijing (76)

Calculation Method of Stresses in Pressure Tunnel Lining Allowing for the Characteristics of Rock Mass Deformations .....Lu Jiayou [7120 1367 0147], Qinghua University (84)

Experimental Research on the Percolation Stability and the Measures for Seepage Control of Dam Foundations which are the Deep Alluvion of the River Valleys in Sichuan.....Liu Linde [0491 7792 1795], Scientific Research Department, Chengdu Hydroelectric Power Survey and Design Institute, Ministry of Electric Power (94)

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Mechanism of Gain in Strength of Lime Soil.....Gao Guorui [7559 0948 3843], Bureau of Chemical Industry Survey Company, Cangzhou, Hebei (111)

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Some Explanations for the Mechanism of Compacted Soils..... Lu Shiqiang [7120 1102 1730], Wuhan Water Conservancy and Electrical Power College (115)

Discussion on Method of Calculation of Plastic Zones of Rock Mass Around Circular Openings Under Asymmetrical Loading..... Wei Fu (116)

Discussion on Deformation of Earth-Rock Dams and Analysis of Cracking and Shearing Rupture of These Dams.....Bian Fuzong [0593 1381 1350] and Chen Yujiong [7115 1937 3518], both of the Water Conservancy and Hydropower Scientific Research Institute, Beijing (119)

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Research Works of Rock Mechanics in Laboratorio Nacional de Engenharia Civil, Lisbon, Portugal.....Huang Renfu [7806 0088 4395], Water Conservancy and Hydropower Scientific Research Institute, Beijing (121)

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Notice of Acknowledgment from Editorial Office..... (131)

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CSO: 4008/145

AUTHOR: CHEN Guozhu [7115 0948 4376]

ORG: East China Water Conservancy College

TITLE: "A New Method for Determining Cohesive Soil Earthquake Pressure and Its Point of Application"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese No 1, 1982 pp 45-54

TEXT OF ENGLISH ABSTRACT: This paper presents a new method for determining the earthquake pressure and its point of application of cohesive soil. On the assumption of plane rupture, formulas are derived for general computer work and, further, this new plane assumption method is compared with the existing and better one. Through examples the effect of various factors is analyzed and a preliminary conclusion is made accordingly.

As the rational conclusion from the achievement of dynamic study is taken into account in the derivation of the formulas, the point of application of the active (passive) earth pressure appears to be higher (lower) in position, which makes the intensity diagram of the active pressure approach more closely the results of FEM analysis. This not only improves the static assumption, but also makes it safer than the existing plane method. The new formulas are clear in physical meaning and rather convenient for taking care of the effect of various factors.

AUTHOR: LIN Peiyuan [2651 1014 3293]

ORG: Guangzhou Railway Bureau, Ministry of Railways

TITLE: "On the Lateral Pressure of Tunnel Linings"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese No 1, 1982 pp 55-62, 54

TEXT OF ENGLISH ABSTRACT: Based on actual measurements of both the lateral pressure sustained by tunnel linings and the internal stresses induced in them, an analysis is made in combination with the cracking and displacement which indicates that the observed lateral pressure is larger than that stipulated in the current Railway Design Specifications, and the practical rock characteristics are more variegated than those catalogued in the specifications. After a briefing of the deformation and stress redistribution in the surrounding rock, the author emphasizes the importance to design practice of the semi-empirical formulas concluded from site measurements.

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CSO: 4009/301

AUTHOR: FU Changsheng [2105 7022 3932]
YU Zaidao [0205 6528 6670]

ORG: FU is a post-graduate, Tongji University; YU is the advisor, Tongji University

TITLE: "A Method of Earthquake Analysis of Soil-structure Interaction Problem"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TONGJI UNIVERSITY] in Chinese No 1, 1982 pp 1-13

TEXT OF ENGLISH ABSTRACT: In this paper the advantages and disadvantages of the mass-spring system and FEM are briefly described in analyzing the soil-structure interaction problem. Furthermore, a modified substructure method is developed based on the general substructure method, taking into account the relative displacements on both sides of the interface. The assumption that the foundation be welded to the ground will no longer be necessary when using this method. The calculated results show that the effect of the relative displacements on the response of the system will be larger in the region adjacent to the foundation.

AUTHOR: ZHANG Guodong [1728 0948 2767]
ZHU Jingchang [2612 7234 2490]
HUANG Huiyu [7806 1920 3768]

ORG: All of Tongji University

TITLE: "Basic Features of Clastic Rocks of the Lower Tertiary Funing Group, North Jiangsu, with Reference to the Source Problem of Its Material"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TONGJI UNIVERSITY] in Chinese No 1, 1982 pp 60-72

TEXT OF ENGLISH ABSTRACT: From four aspects, i.e., the composition of the terrigenous clasts and the typomorphic features of the minerals, authigenic minerals, cements and matrix, the type of clastic rocks as well as the changes taking place after the burial of the sediments, this paper clarifies the basic features of the clastic rocks of the area. Some of their features indicate that the sediments were transitional in nature between the meritic sea and land, and were influenced by the action of saline water and fresh water dually and successively. The changes taking place after the burial of the sediments have some effects on their physical properties. As for its source of material, it is multi-origined, although it mainly owes its origin to the metamorphic rocks and granite mass in the southwestern margin of the basin.

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CSO: 4009/300

AUTHOR: PEI Henian [5952 7729 1628]
ZHOU Suhua [0719 4790 5478]
ZHAO Shijin [6392 6108 6855]
YANG Shize [2799 0013 3419]

ORG: All of the Research Institute of Comprehensive Utilization of V-Ti-bearing Iron Ore, Chongqing University

TITLE: "The Changes of Phase Compositions and Hardening of Panzhihua Iron Concentrate Pellets"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 1, 1982 pp 1-10

TEXT OF ENGLISH ABSTRACT: In order to find out the hardening mechanism of the V-Ti-bearing iron ore concentrate pellets, this paper presents the laboratory research results on phase composition and pellet hardening changes. The oxidizing reactions, structure of briquettes and the effects of high temperature roasting and of carbonate additives on the structure of the pellets are discussed. Investigation revealed that good quality pellets may be obtained by roasting at 1250°C the briquettes made with fine ground iron concentrates. The size of Hematite crystals does not materially affect the hardening, but the effect of recrystallization is important for the reformation of the structure of the pellets, i.e., the solid reaction forms close

[Continuation of CHONGQING DAXUE XUEBAO No 1, 1982 pp 1-10]

packing of stable Titanium-Hematite with other minerals. The hardening of Panzhihua iron concentrate pellets mainly depends on the completeness of oxidation, proper control of the roasting temperature and slag phase, forming a stable structure and phase composition with Titanium-Hematite as a framework or skeleton.

AUTHOR: HUANG Zongqing [7806 1350 0615]
YANG Yuru [2799 7183 1172]

ORG: Both of the Department of Physical Chemistry, Chongqing University

TITLE: "An Ellipsometric Study for the Growth of Surface Films on Titanium in Chloride Solutions"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 1, 1982 pp 11-19

TEXT OF ENGLISH ABSTRACT: In order to determine the corrosion resistance of titanium in HCL and NaCL solutions, the progress of the surface film growth on titanium in these solutions was studied by ellipsometry. Results showed that the rate of growth of surface film on Ti follows the direct logarithmic law only at the initial stage, with the rate turning to parabolic law after the film reaches a certain thickness. This shows that the corrosion resistance of the surface film of titanium is not very good. In this paper, the anodic polarization and breakdown potential of titanium in chloride solutions are also investigated. The problem of improving the corrosion resistance of titanium is discussed, too.

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SCIENCE AND TECHNOLOGY

No. 162

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APPLIED SCIENCES

TECHNICAL, ECONOMIC INDICES REACH ADVANCED NATIONAL LEVEL

Kunming YUNNAN RIBAO in Chinese 31 Jan 82 p 1

[Article by Chen Xuecui [7115 1331 4733], Xu Desen [1776 1795 2773]: "Luxi Nitrogen Fertilizer Plant Learns Advanced Techniques With the Help of the Shanghai Coordination Group, Technical and Economic Indices Have Reached the Advanced National Level"]

[Text] Luxi County Nitrogen Fertilizer Plant conscientiously learned the advanced management experience and advanced technology in Shanghai with the help of the Shanghai coordination group. In December of last year, it produced 2,940 tons of chemical fertilizers a month at a cost of 100 yuan per ton. It consumed 1,667 kilograms of coal and used 1,253 kilowatt-hours of electricity. Not including subsidies, the plant earned a net profit of over 156,000 yuan, the best record in the history of the plant. The main indices for output, quality, consumption, cost and profit all reached the advanced level of similar plants in the same industry throughout the nation.

Luxi County Nitrogen Fertilizer Plant invited the Nanhui Chemical Plant and the Wusong Chemical Fertilizer Plant in Shanghai to send a special coordination group to come to the plant and help. The party organ of the plant mobilized the workers of the whole plant humbly to learn the advanced management experience and scientific technology of Shanghai. The comrades of the Shanghai coordination group conducted a conscientious survey and study and proposed 58 suggestions on rationalizing operations. Except 16 suggestions which could not be implemented at present because of the limitations of budget difficulties, 42 suggestions have been organized and implemented. Comrades of the Shanghai coordination group helped the plant popularize the various economic responsibility systems that have been effective in the Shanghai area, strengthened business management, taught technology, led in ideas and style of work, and served as personal examples. The standard of operation and the technical standards of the workers were improved. High output, low consumption, safety and various technical and economic indices all advanced to lead the whole province in joining the ranks of the advanced levels of the whole nation.

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POWER SYSTEM OVERCOMES DIFFICULTIES IN GENERATING ELECTRICITY

Kunming YUNNAN RIBAO in Chinese 2 Feb 82 p 1

[Article by Yang Liyi [2799 4539 5030], Yang Xuanmin [2799 6693 3046]: "Lift Up the Spirit and Energy, Overcome Difficulties To Seize High Yields, the Provincial Power System Generates and Supplies More Electricity in January"]

[Text] The broad number of cadres and workers of the provincial power system lifted their spirits, overcame difficulties, and exerted efforts in production. Up to January 29, they had completed generation of over 298 million kilowatt-hours of electricity, the highest level created during a similar period in the past.

Since last winter and this spring, our province has been in a season of drought. Water reserves are insufficient and hydroelectric power cannot generate more electricity. This has made the task of generating electricity by thermal power stations heavier. At the end of December of last year, the leadership of the Provincial Electric Power Bureau led the bureau's cadres in conducting surveys and studies, and held a system-wide cadres meeting. They conscientiously analyzed the production trends, and established concrete measures to guarantee completion of the task. After 1 January, the leadership of the bureau went, with members of related departments, to the localities to implement fuel supply and they guaranteed the need for coal by the various thermal power plants. At the same time, they conscientiously managed equipment repairs. In January, they inspected and repaired 23 boilers, 3 substations, 11 high voltage transmission lines, and created good conditions for safe generation and ample supply of electricity.

The cadres and workers of this system stood firmly at their work post in the spirit of being master, generated more electricity and supplied more electricity. Xuanwei Power Plant had a heavier task of generating electricity this year. The workers of the entire plant thought of many ways to develop potential. Besides inspecting and repairing the generators according to plan, all of the remaining generators were operating. In January, the highest daily output of electricity reached 3,812,000 kilowatt-hours, unprecedented during any similar period of the past. During the two holidays in January, the leading cadres of every production unit of the whole system joined engineering and technical personnel and insisted on working with the shifts to direct production. They have contributed to guaranteeing electricity for the whole province's industrial and agricultural production and electricity for people's living.

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CODING CHINESE CHARACTERS

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese
No 1, 1982 pp 41-46

[Article by Xu Jialiang [6079 1367 2733] of the Tianjin City Scientific and Technological Information Institute: "Understanding Several Questions in the Study of Coding Chinese Characters"]

[Text] When we use a computer to process the information of written Chinese characters, we must first solve the problem of how Chinese characters can be entered into the computer. This means, we must solve the problem of how to digitize the information of Chinese characters and change the information into binary electrical signals. For this, people have used many different methods to convert the information of Chinese characteris into codes composed of Latin letters, Arabic numerals or other symbols, and have used these coded forms to enter Chinese characters into the computer. There must be a definite correspondence between the codes and the Chinese characters they represent. After Chinese characters are entered into the computer in coded form, throughput of computer processing must be orderly. At output, the Chinese character that has been entered first must be output first. This work is what people call "coding Chinese characters."

The study of coding Chinese characters is a key link in realizing computer processing of Chinese character information. Its importance is being understood by more and more people. More and more scientific and technical personnel and amateurs are participating in the study of this subject. According to our understanding, there are already over 100 Chinese character coding plans in China and abroad. These plans all have their own advantages. Some plans have already been tested in Chinese character information processing systems. Welcome results have been obtained. However, most of the plans, due to various causes, are still at a "planning" stage at present. On the one hand, the plans that are in the "planning" stage are being studied further in theory to make them perfect. On the other hand, various occasions are being used to advertize their superiority to attract the attention of concerned departments and to create conditions for on-line tests.

These different plans are categorized in Table 1.

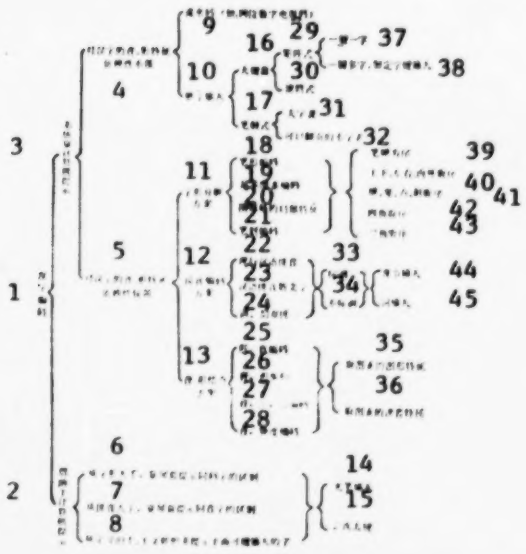
It is believed that, in the future, new plans will be proposed and there will be far more than those available at present. Then, how can the best plans be selected from among so many plans in the future? How should we establish the technical standards to judge the merits and demerits of these plans? Should Chinese character information input be mainly ideographic or mainly phonetic? What kinds of limitations exist in the present study of Chinese character coding? How can these limitations be overcome? From among these several hundred plans, should one plan be selected as the final one or should several plans be selected simultaneously? These problems face us and they need to be solved.

The above questions are mutually related and interwoven and they cannot be easily separated for individual discussion. I will talk about my shallow personal views regarding the above.

I. Comparison of the Coding Plans

Different situations in processing Chinese character information require different types of Chinese character coding schemes. The different situations in processing Chinese character information mentioned here include the following two aspects:

Table 1. Classification of Chinese Character Coding Schemes



Key:
1. Chinese character coding
2. Relying on prompts by computer
3. Not relying on prompts by computer
4. Not strongly dependent upon the ideographic and phonetic characteristics of Chinese characters
5. Relatively strong dependence upon the ideographic and phonetic characteristics of Chinese characters
6. Starting out from the ideographic form, relying on prompts on screen to differentiate between characters of the same code
7. Starting out from spelling, relying on prompts on screen to differentiate between homophones
8. Prompting possible input of characters by context
9. Continuous code (such as four-digit telegraphic code)
10. Whole character input
11. Scheme of separating parts of the ideographic form of the character
12. Spelling and coding scheme
13. Scheme of combining ideographic and phonetic characteristics
14. Light pen input
15. Double striking of keys
16. Large keyboard
17. Pen-touched

[Continuation of Key for Table 1]

18. Coding the shapes of strokes
19. Basic diagrammatic coding
20. Characteristics of partial diagrammatic structure
21. Coding the number of strokes
22. Current version of romanized spelling (pinyin) for Chinese characters
23. New romanized spelling of Chinese
24. Double spelling of phonetic and tone
25. Coding ideographic form and phonetic
26. Coding phonetic and ideographic form
27. Coding phonetic, ideographic form and meaning
28. Phonetic and frequency coding
29. Matrix
30. Roller
31. Large character table
32. Paginated small character table
33. Marked for tone
34. Not marked for tone
35. Taking the graphic characteristics of the ideogram
36. Taking the characteristics of pronunciation of the ideogram
37. One key per character
38. One key for many characters with additional character selection key input
39. In order of strokes
40. Ordering by up, down, left, right, in and out
41. Ordering by horizontal, vertical, dot, slanted strokes
42. Ordering by the four corners
43. Ordering by three corners
44. Syllabic input
45. Term input

1. Processing of Chinese character information has different purposes: communications, publication and printing, file management, information search, consulting service, translations between Chinese and foreign languages, etc. The different purposes will present different demands upon the method of Chinese character input, and the requirements of the various technical specifications for coding Chinese characters will also have different emphasis.

2. When processing Chinese character information, the equipment and conditions upon which it has to rely are different. The educational level and technical level of the operators are also different. All coding schemes are considered and designed for use on the computer, therefore, the schemes will make definite demands upon the equipment that is to execute them. Conversely, fixed conditions and ability of a computer limit and present definite demands upon the Chinese character coding scheme for that computer. In Chinese character information processing, the Chinese character coding scheme and the technical level of the computer are mutually dependent and mutually limiting. For example, if the capacity of the computer in use is small, its requirement for code length will be more outstanding. Again, for example, if the number of Chinese characters compiled is too large, the capacity of the computer must be large. If the computer used has complete functions and

strong functions, then the burden on the operator will be light. Conversely, if equipment of lower capabilities is used, the human operator's burden will be heavier.

Since different situations for Chinese character information processing present different requirements for the Chinese character coding schemes, when proposing one kind of Chinese character coding scheme we must first understand for which main purpose this coding scheme has been proposed. What are the demands upon the equipment it utilizes, and what are the demands upon the users and operators? Only with a clear understanding of the purpose and goals of the design, and with established technical conditions, can there be a basis for judging whether that scheme meets the expected goals. Otherwise, if the schemes are separate from their purpose and their working environment, and if various schemes are taken as is to serve as the criteria for comparison, the problems cannot be completely explained.

Any type of scientific research or design must have a written statement explaining such scientific research and its design or something similar. Even when such a goal is not issued by a department, we must establish a starting point for ourselves and propose a basic requirement and definite limiting conditions. Then we can begin scientific research or design. Research in Chinese character coding is also the same. Which equipment will your scheme be prepared for? Or, what kind of machine will you be relying on to realize your scheme? No matter how one considers the problem, one can only establish one condition and then seek a solution. One cannot study the problem universally. One cannot separate the problem from fixed material conditions (personnel, function of the machine and capacity, particular processing, etc.) in pursuing various kinds of lofty goals. Even computers have various models and various uses, let alone the Chinese character coding schemes for computers. How can we imagine there is an all-purpose "miracle drug"?

Some people believe that even though the equipment of the large keyboard whole character input method is large and more time is required to train the operator, it is superior in electronic phototypesetting. It is worth their while for professional typesetters to spend a certain amount of time in training to master it, and it is necessary that publishing and printing units acquire this type of equipment. In this special situation, people appreciate its direct visibility, its simplicity of operation and the few number of keying operations required.

In communications, the outstanding problem is accuracy and speed. The performance of such work as receiving and sending telegrams requires professional personnel. To the professional telegraph operator, it is absolutely necessary to spend a definite period of time in learning a new telegraphic code. Telegraph operators must memorize telegraphic codes and must use them skillfully. Whether it is a continuous code, an ideographic and phonetic code, a phonetic and ideographic code or a pure combined spelling code, people have higher demands regarding code length and the percentage of repeated codes, while the time required for training operators and other such goals are of secondary importance. In transmitting Chinese character information using computers, it is necessary to "see the character and recognize the code," while the necessity of "seeing the code and recognizing the character" is not great. This is because converting telegraphic codes into Chinese characters relies on the machine, not on manual labor. To be able to "see the character and recognize the

code" and also to be able to "see the code and recognize the character" are not demands upon Chinese character coding for the computer, but demands upon the person who translates telegraphic codes.

Codes based on ideographic form for input of lengthy texts of Chinese characters are more superior. The characters that appear in the text are directly input into the computer without going through a transition of phonetic spelling. The more intermediate links there are, the more chances there are that mistakes will occur. Ideographic codes can be free from the interference of regional dialects and dental sounds, and they will not be limited by inaccurate tones or unfamiliar words. Even people who cannot read Chinese characters at all will be able to input Chinese characters into the computer by this coding method based on ideographic forms. Because the level of the operator's knowledge of the Chinese language has been relaxed to a certain degree, specifications for code length cannot be strict.

In situations of information search and consulting applications, if professional service personnel must be relied on to communicate with the computer, then the specification for speed must be higher. The training time of professional personnel must be a secondary consideration. But, when setting up computer terminals for a massive number of user units (research institutes, factories, mines or higher educational institutions which require information searching), if one to two additional computer keyboard operators have to be added whenever a terminal is set up, it would not be economical and convenient. In this case, the ideal situation should be that everyone who searches for information can communicate directly with the machine and before they communicate with the machine they should not have had much training or should not have to have any training in Chinese character coding. At the same time, when conducting man-machine conversation, the burden upon the human brain must be as light as possible, Yet, to reduce the human burden, the tasks borne by the machine will have to be heavier. Lowering the requirements of the operator will increase the demands upon the machine. Under this situation, using the "prompt" function of the computer to "prompt" the Chinese character codes for the operator seems very necessary. If the man-machine conversation is "conversational" (or "question and answer"), input by spelling (pinyin) would be more direct than input by ideographic form. If all the information to be communicated by the machine had to be written in Chinese characters beforehand, then each Chinese character would have to be coded by looking at the shape of the strokes, and that would be too cumbersome. Even if the Chinese characters are not written out, every Chinese character has to be written in thought and its code has to be recalled mentally according to its strokes. In this way, the burden on the human brain will be very heavy, and this is not consistent with the habits of human "conversation." There are many difficulties. The coding scheme of "spelling - prompting" of Chinese characters has been proposed mainly for this situation.

In general, we cannot separate the schemes from the various goals of application and from the fixed conditions of the computer to simply compare the technical specifications of coding. The important thing is whether the scheme can realize the purpose for which it is intended at the time it is proposed, and whether manpower and material conditions can allow its realization. We can then select the scheme which has the highest coding efficiency, the one with the lowest percentage of repeated codes, and the one with the best performance under these prerequisite conditions.

II. Relationship between Ideographic Form and Sound

Should computer input of Chinese character information be based on form or on phonetics? This is determined by which form is used for input, and the purpose of input in such a form. This is based on the same reason that research cannot be separated from fixed and concrete conditions as discussed in the first part of this article.

Some comrades believe that since it is termed "Chinese character input" and "Chinese character coding," we must necessarily work on the Chinese characters. But any written Chinese character must be expressed by a fixed ideogram and, as a language, these characters must be based on ideograms.

This writer believes that the "written language" is a written expression of the form of a language. "Written words" and the basic unit "word" (i.e., syllable) of our Chinese language are not the same concept. The "word" in the language written on paper first expresses its form. When enunciated, the first expression is its sound. Ordinarily, we say that a certain person "enunciates clearly." Although this relates to the concept of "words," it does not refer to the "written word" that is written on paper and that has a fixed ideographic form. The illiterate can also "enunciate words." When two illiterates exchange thoughts, although the statements are composed of "words," these "words" do not include the concept of the graphic symbols of the writter words during the course of exchange of thoughts. Before our ancestors created and used "written words," they had already been using a language with the "word" as the basic unit to engage in exchange of thoughts. Later, they recorded the "words" spoken by mouth onto oracle bones, bronze, bamboo slips, silk, paper, etc., and they used a fixed graphic symbol to record a fixed pronunciation and its meaning, and thus the "written word" was born. Therefore, exchange of thoughts between people need not be talking face to face. People could transmit or retain "words" of the language via a carrier of a fixed graphic language. The graphic language carrier is the means or tool for transmitting the "words" of the language, but not the only means. For example, after the telephone was invented, not everything had to be written in letters (This means, it was not necessary to go through the procedure of writing "words" of the language down on paper as "written words").

Conversation between man and machine follows this principle. Whether to input the "words" of the language directly (here we are not talking about the problem of voice recognition) or to input the written "words" depends on the need. Different needs determine whether the input should be based on phonetics or whether the input should be based on ideographic form. We must not separate it from the purpose and the conditions in use and abstractly analyze it. Like telephone conversation, it cannot replace writing letters and writing letters cannot replace telephone calls. Each has its usefulness.

The term "Chinese character coding" or "Chinese character input" is the name we have given to this work. Its nature is to study how man and computer can (using the Chinese character as the basic unit) converse in the Chinese language. It can never be separated from the true nature of the man-machine conversation to simply study

the written form of Chinese characters. Therefore, whether "Chinese character input" should be based on ideographic form or on phonetics cannot be limited to the name that we have used. This writer believes "Chinese character information processing" should be understood as computer processing of the body of written words of the Chinese language. It is not simply the processing of the written character that is written down and that has a fixed ideographic form.

Compared to the language systems of nationalities that already use completely alphabetized languages, the ideographic forms of the Chinese language indeed contain much more information than alphabetic languages. There are more difficulties in inputting the ideographic forms into the computer. This frequently makes people believe that Chinese character information processing is mainly processing of the information of the ideographic forms of the Chinese characters, and it is easy to start out by studying the ideographic forms of Chinese characters. Actually, neither studying phonetic representation nor studying ideographic representation should be abandoned. When inputting lengthy written texts into the computer, the first thing one comes into contact with is the "ideographic form" of the Chinese characters. When "conversing" with the machine involving questions and answers and where there is a strong randomness, the first reaction of the human mind is the sound and the meaning of each character. The reaction to the strokes and shapes of the characters is not fast. Therefore, different situations in use emphasize different aspects regarding whether to base input on phonetics or to base the input on ideographic form. Of course, it is entirely possible to establish a set of multipurpose Chinese character codes which can designate the same Chinese character whether the input is phonetic or ideographic. But this requires increasing the amount of work for the software and this will also present some special demands upon the machine. In general, consideration of the problem still cannot be separated from the purpose and the conditions in use.

III. The Question of Coding Efficiency and the Percentage of the Same Codes

Examination of the efficiency of coding and the percentage of the same codes also cannot be separated from the purpose and conditions of use.

Obviously, the shorter the number of bits of the code, the higher the efficiency of coding. Yet, the coding efficiency and the percentage of repeated codes are mutually limiting. Whether we start out from the radicals or from the strokes or from spelling in coding, the number of times a basic symbol is used in coding Chinese characters is different. In other words, regardless of which characteristic of a stroke we use or which characteristic spelling we use to categorize and queue Chinese characters, the distribution of Chinese characters is not even. Therefore, if we limit the length of the code, many Chinese characters with the same characteristic will be overly concentrated and, by necessity, they will have the same code. This means: Codes of definite length are not sufficient for differentiating the characteristics of these Chinese characters. Yet, if we divide these Chinese characters with the same code further, then we must add another code to designate their different characters, and thus the number of digits of the code will be increased. In this way, the percentage of the same code will be lowered, but for those Chinese characters that do not share the same code originally, this code seems too long. The digits of the codes would be wasted, and the coding efficiency is reduced.

The fact that no matter which characteristic of Chinese characters is used for classification, the distribution of Chinese characters with that particular characteristic is not even has determined that examination of the coding efficiency and the percentage of the same code must be combined. The requirements specified by the goal of coding and the possible equipment which the codes will rely upon must be combined to decide whether to place more emphasis on coding efficiency or the percentage of the same code, and to what degree such emphasis should reach.

Of course, using codes of unequal length to take care of both coding efficiency and the percentage of the same code is one way. Yet, when an operator follows a certain rule in coding Chinese characters for input, he cannot foresee whether this character shares the same code with another character and how many characters are sharing the same code. He cannot know whether to use more detailed rules to distinguish the characters sharing the same code. Certain special rules established for codes of different lengths (including rules for abbreviations) have to be memorized by the operator and this increases the burden on the human brain.

At present, when people examine the percentage of the same codes in coding Chinese characters, they frequently calculate it by counting the number of characters sharing the same code or the number of pairs of characters sharing the same code appearing in coding a fixed number of Chinese characters. In this method of calculation, every Chinese character is treated equally.

Yet, different Chinese characters have different frequencies of occurrence in use. The emergence of characters with the same code has a different effect when the same code occurs with commonly used characters or with rarely used characters. Therefore, the above method of examining the percentage of the same code is not very scientific.

Actually, certain situations can permit a small amount of characters with the same code to exist when coding Chinese characters. Whether in Chinese or in foreign languages, there are homonyms, heteronyms, words of the same form but different in meaning. In a sense, these are also the same codes. The phenomenon of having the same code in a language or a written language does not prevent Chinese or foreign languages from being used over long periods. Why is it intolerable to have a few characters with the same code in the study of coding Chinese characters? As long as the few characters with the same code do not cause misunderstanding and serious errors in use, is it therefore necessary that we be so technical and perfect?

Many comrades are using many methods in mathematics to study coding efficiency and the problem of the same codes in coding Chinese characters. They have accumulated much useful information and data for the study of Chinese characters. Basic theoretical research in coding Chinese characters is necessary for the design and implementation of coding schemes for Chinese characters. But, when it involves a certain coding scheme to actually code 10,000 Chinese characters or 4,000 commonly used technical Chinese characters, the number of characters with the same code can be counted easily. The coding efficiency is also easily counted and compared. In the course of designing a certain coding scheme, and when creating a Chinese character code dictionary, the problem of having the same code and the problem of coding efficiency will be manifested very clearly. The properties of every set of

characters with the same code must be concretely analyzed. The degree of occurrence of characters with the same code in the course of use must also be concretely analyzed. At the same time, we must combine the actual situation of use and the actual technological condition of the computer to determine the processing method.

IV. Breaking Away from the Limitations of the Method of Research of Coding Chinese Characters

The Chinese characters left us by our ancestors at first were not created for use solely by the computer. And neither was the presently available computer designed specifically for processing Chinese character information. Therefore, coding of Chinese characters cannot be a stubborn matching of certain characteristics of Chinese characters with Arabic numerals or Latin letters. This means, the connection between the characteristics of the sound and the ideographic form of Chinese characters and the coding symbol must not be forced. Otherwise, the codes would not be easy to remember and they would not be easy to use. In studying and designing various coding schemes, obstacles presented by the ideographic structure or phonetic structure of certain Chinese characters have been encountered. Some phenomena that have been difficult to handle have been encountered. Therefore, further reform of Chinese characters from different angles has been proposed. Because the understanding and the thoughts in the research of various types of codes at present are not unified, opinions on how to reform Chinese characters to realize the use of the computer to process Chinese character information have been difficult to unify. They are still far away from forming a force that can influence the direction in the development of the work of reforming Chinese characters. Also, the problems involved in the work of reforming Chinese characters are more difficult than the work of coding Chinese characters. The research in coding Chinese characters will serve to promote the work of reforming Chinese characters, but it will never replace the work of reforming Chinese characters. Coding Chinese characters must not be done by "cutting one's feet to fit the shoes." Of course, defects that truly belong to the feet should be treated, but requirements must also be made upon the "shoes" that are to be worn. To realize the use of computers to process Chinese character information, we must not only have the efforts of comrades engaged in coding, we must also have the common efforts of comrades engaged in computer hardware and software. To realize the goal of Chinese character information processing by computer, can we make certain demands upon computer hardware and software? Can we develop a computer language based on the Chinese language system? When we design coding schemes, why do we have to limit ourselves to the presently used Latin letter keyboards? For example, would developing a fixed keyboard of initial consonants and compound vowels for Chinese eliminate the necessity of the operator having to memorize the double spelling rules? Using the computer's "prompt" function, we can let the computer prompt the codes that differentiate between characters of the same codes, and will this not reduce the mental burden on the operator? In certain situations where the speed of input of Chinese characters is not overly emphasized, fully utilizing the computer's potential to add a buffer between man and machine and develop a second input is feasible.

Although Chinese characters at first were not created for today's computers, and the present computers were not specifically built for Chinese characters, the study of coding Chinese characters must go beyond the simple method of studying Chinese

characters for the sake of Chinese characters. Coding Chinese characters must not be done by drawing one's own "prison walls." We should not be afraid to step outside the circle of studying Chinese characters just because we are engaged in "Chinese character coding." The study of Chinese character coding should be combined with the study of the main frame of the computer and peripheral equipment, and it should be combined with the study of computer software. We should utilize computer equipment and technology as much as possible so that when people use this coding scheme to input Chinese characters, the mental burden can be lessened so that the goal will be consistent with the goal of using the computer to process Chinese character information (we must not let the brain work as a tired "decoder").

To make new progress in the work of Chinese character information processing, certain limitations now present in the method of studying Chinese character coding must be broken.

V. Chinese Character Coding Must Combine Three Aspects

Chinese character coding work must be a three-way alliance of the user, the coding personnel and computer personnel. At present, relying on written or verbal arguments to prove the superiority of a certain coding scheme is far from enough. We must grasp on-line tests and we must grasp the study of auxiliary equipment and software research. No matter how, we cannot let the coding of the shapes of strokes lag behind the use of the computer in recognizing the ideographic forms of Chinese characters. We cannot let the study of phonetic coding lag behind the study of using the computer to accept Chinese voice input. We cannot let the study of differentiating between characters of the same code lag behind the study of artificial intelligence in computers so that the computer can recognize characters of the same code by context.

The present Chinese character coding work is mostly conducted by enthusiasts during their spare time. Although the enthusiasm of spare-time research is precious, efforts that always remain as spare-time efforts will not benefit new breakthroughs in the study of Chinese character information processing because a person's energy is limited. Within a definite time, specifically arranging a fixed number of people and materials to combine the advantages of all the schemes and to produce several coding schemes suitable for different situations is very necessary. Also, in such research and experiments, there must be users of various types of computer systems.

Research combining these three aspects not only will benefit the progress in the study of coding Chinese characters, but it can be believed that it will also serve to push forward our nation's scientific research, design and applied technology in computers.

VI. Selecting the Best Coding Scheme

To avoid repetition and waste, and to hasten the progress in research, the presently available Chinese character coding schemes must be categorized, summarized and screened.

The purpose of screening the schemes is not to arrange the schemes in order of superiority or inferiority (and, in addition, schemes used for different purposes and different situations cannot be placed together and ranked), but to find the advantages and the shortcomings of each scheme so that the advantages of each can be combined to make up for the shortcomings of each and to develop several coding plans that suit China's situation and that have different uses. Therefore, the limitations of the authors of different coding schemes must be broken. The traditional method of research, like small handicraft production, must be broken.

As long as we keep in mind a clear goal of selecting the best and the objective criteria of not separating the schemes from the purpose and situation in use, then in the screening process we can eliminate man-made factors of interference to the maximum extent.

Selecting the best must not only be done in theoretical specifications, we must also select the best in practice. The proposers and researchers of all kinds of schemes can all argue the superiority and inferiority of the schemes, but the users of various applications systems will have more say in the conclusion from the user's viewpoint. Therefore, just the proposers and researchers of coding schemes cannot sufficiently constitute the entire membership of the organization to evaluate and select the schemes.

VII. Chinese Character Coding and Chinese Character Information Processing

The subject of computer processing of the Chinese language system requires a systems engineering point of view. Although Chinese character coding is one key link, it is only a very small prelude to the entire process. Simply entering the codes at one end and printing out or displaying corresponding Chinese characters cannot constitute complete success in computer processing of Chinese character information. A lot of work has to be done in computer software, peripheral equipment and in the computer mainframe. To enable the Chinese characters entered into the computer to be connected in syntex within the machine, to enable the computer to understand the linguistic structure of Chinese and automatically process the input information, a lot of research and exploration is still required. This work is more difficult and more complex than defining codes for every Chinese character. There is a lot to be done in the Chinese character input keyboard, the means of displaying Chinese characters and the means of printing Chinese characters. In general, each link in the system is indispensable. There is an organic connection between every link and every other link. To realize automation of Chinese character information processing soon, comrades engaged in computers should understand more about the research in coding Chinese characters. And comrades engaged in coding Chinese characters must understand more about the computer.

9296
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APPLIED SCIENCES

RESEARCH COMBINES WITH PRODUCTION, SERVES ECONOMIC READJUSTMENT

Guangzhou GUANGZHOU RIBAO in Chinese 12 Feb 82 p 1

[Article by Ye Lihan [5509 7787 7281]: "Scientific Research Combines Closely With Production, This Promotes Production and Enlivens Scientific Research, Last Year, 34 Scientific Research Achievements Began Production in the City's Industrial Frontline, Creating Over 50 Million in Production Value, Funds for Scientific Research Were Replenished, and This Promoted the Development of Scientific Research Work"]

[Text] Our city's scientific and technological work has been closely combined with production to serve economic readjustment. The achievements increased over those of the past and began production more quickly. According to incomplete statistics, last year alone, our city's industrial frontline popularized and began production of 34 scientific research achievements, creating over 50 million yuan in production value and realizing a profit of over 10 million yuan.

Insisting on applying scientific research, starting out from the actual situation, following the policy of mainly developing light and textile industries in our city's buildup, and arranging production projects according to social needs are the main reasons that our city's scientific research work is active. The Guangzhou Chemical Engineering Institute completed a total of 125 scientific research projects since its inception to 1979 but only 36 achievements were produced and applied, or only 28.8 percent. After implementing the readjustment policy, projects of study were selected by starting out from practicality, and as a result, last year, 11 projects were completed, and 10 of them were popularized and applied. Since last year, this institute developed 590,000 spare and accessory parts of 64 types in 15 major categories for the textile industry, the sewing machine industry, electric fan and television manufacturing. The institute has contributed to the development of our city's industry.

Technical joint ventures and cooperation between scientific research units and production departments are an effective way. At present, our city implements technical joint ventures mainly in four ways: The first is to sign technical contracts. After the scientific research unit completes the commissioned projects, the commissioning agency pays the scientific research fees. The second is the joint development of new products by the research institutes and

the factory. Scientific and technical personnel go the factories to work together with factory personnel and help solve actual problems in production and develop new products. The third is the establishment of fixed cooperative relationships between the scientific research units and the production departments and signing of a joint venture agreement in technology. For example, the Xinbang County Fruit Trees Research Institute, the country's fruit company, the supply and marketing cooperative and the local production brigade jointly established an experimental fruit farm to cooperate in technology, production and capital investment. The income was shared proportionally by the units. The fourth is combining the factories and the institutes to establish a joint scientific research and production entity mainly engaged in scientific research, such as the joining of the city's Pharmaceutical Plant No 9 and the city's Pharmaceutical Industry Research Institute so that research and production can become one entity.

The close combination of scientific research and production has hastened the speed of scientific research projects conducted by scientific research units, and the funds for scientific research by scientific research units have been replenished, thus promoting the development of scientific research work. The city's Automatic Control Research Institute has taken the initiative in joining the factories and enterprises over the past 2 years. It has signed 13 contracts of technical joint ventures with production departments. Seven projects have already been completed and have been handed over for use. The income amounted to over 300,000 yuan. This has enlivened scientific research work at the institute.

The combination of scientific research and production has forcefully promoted the development of production. The city's Rubber Research Institute has closely joined the production needs of its own industry for several years to develop research. It has contributed greatly to our city's rubber production. The institute helped the 13th Rubber Plant apply and popularize the technique of extender synthetic rubber. The percentage of extension increased from 30 percent to 40 percent. The plant increased its revenue by 470,000 yuan within half a year. The institute also helped the Third Rubber Plant solve the technical problems in manufacturing plastic basketballs. This product won the silver medal in the national quality evaluation last year. The factories of the rubber manufacturing sector commented that the work of the rubber research institute has become a helpful vanguard in our development of rubber production.

9296
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CHINESE SEMICONDUCTOR PROGRESS

Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 12, Dec 81 pp 2-3

[Article by the Department of Devices, Chinese Radio Equipment Company: "Development of Semiconductor Integrated Circuits in Our Nation"]

[Text] Since the advent of integrated circuits at the end of the 1950s, there has been a history of only 20 years of development. But they have served very importantly in modern science and technology and they have made important contributions to mankind. In the 20th century, man has landed on the moon, launched spacecrafts that travel to Venus and Mars and even to further star systems. Man has developed legend-like offensive, interception and defensive systems in electronic warfare, very capable robots used in modern and highly automated mass production, electronic devices that have penetrated all realms of human society, and even microprocessors that can replace housewives.... All these are miracles that have occurred only after the advent of the integrated circuit. Therefore, the level of development of integrated circuitry has already become an important indicator to measure the level of modernization of a nation.

China began developing integrated circuits at the beginning of the 1960s. In 1965, the first integrated circuit was successfully developed. Now, our nation can manufacture over 500 varieties, with an annual output reaching 40 million units. But the proportion of the world output (in 1979, this had reached 6.1 billion units) is still very small, and most of the units are still medium- and small-scale circuits. In large-scale integrated circuits, a test production line with a definite percentage of final products has already been established for 1024-bit and 4096-bit random memory units.

There are many types of integrated circuits. According to circuit structure, they can be divided into the bipolar type and the MOS type. According to circuit functions, they can be divided into digital circuits and analog circuits. According to the scale of integration, they can be divided into small-scale, medium-scale, large-scale and superlarge-scale circuits.

At present, there are seven categories of semiconductor integrated circuits being produced and developed on a trial basis in China. The are separately described below:

1. TTL Circuit

This is a transistor-transistor logic circuit that is widely used in our nation. It constitutes about 50 percent of the total domestic production. There are a total of five series. The major producers are the Beijing 878 Plant, the Changsha 4435 Plant, the Second Beijing Semiconductor Devices Plant, the Sixth Plant, the Tianjin Semiconductor Plant, the Shangwu 19 Plant, the Shanghai 8331 Plant, the Changzhou Semiconductor Plant and the Suzhou Semiconductor Devices General Plant.

(1) T000 Series This series basically follows the design of the series 74 products of the Texas Instruments Company of the United States. The design started out from the actual situation in China and the various parameters are slightly lower than those of the 74 series. This series includes 28 types of medium-speed small-scale circuits, 26 types of high-speed small-scale circuits and 61 types of medium-speed medium-scale circuits.

(2) T1000 Series This series is completely the same as the SN74/54 series products of the Texas Instruments Company of the United States. There are a total of 101 varieties of medium- and small-scale circuits. Their logic functions are more complete and they can satisfy whole machine logic design requirements.

(3) T2000 High Speed Series This series has been developed as a copy of the American SN74H series. It uses a shallow saturation structure. A total of 23 varieties has been selected.

(4) T3000 Very High Speed Series This series has been developed as a copy of the American SN74S series. It is a Shockley anti-saturation circuit. A total of 58 varieties has been selected and the series is a key series for development in our nation.

(5) T4000 Low Loss High Speed Series This is a product that imitates the American SN74LS series products. A total of 109 varieties has been selected. This is a circuit that urgently needs to be developed in China. At present, it does not have a fixed product type.

2. HTL Circuit with a High Resistance to Interference

This series is similar to Japan's Toshiba products. The resistance to interference can reach 6 volts. There are a total of 16 types, including 11 types of gate circuits and 1 type of trigger, and 4 types of medium-scale counting, decoding and memory circuits. They can basically satisfy the designed requirements for industrial control machinery. The main production plant is the Third Beijing Semiconductor Devices Plant and the Nantong Transistor Plant.

3. ECL Ultrahigh Speed Counter Circuit

The domestic ECL circuit is designed mainly on the basis of the MC10100 series and the MC10500 series of the Motorola Company of the United States. The average gate delay is generally smaller than 2 millimicroseconds and it is less than 0.7 millimicrosecond for submillimicrosecond products. The circuit is mainly used in large

and super-large high-speed computers, space flight and satellite communications equipment and microwave measurement devices. The main production plant is the Qinan 871 Plant.

4. PMOS, NMOS Circuits

The PMOS circuit is simple in structure, its degree of integration is high, and its cost is low. In 1980, total sales by all plants reached 2.5 million units. Domestically it is mainly used in desk-top computers and numerical control devices. Because PMOS is low speed, its power consumption is large, the voltage of the power source is high and its development is limited. The main production plants are the Fifth Shanghai Elements Plant, the Nantong Transistor Plant and the Fifth Beijing Semiconductor Devices Plant.

Except for individual varieties of NMOS circuits, most NMOS circuits are single power source circuits with a power source voltage of +5 volts, compatible with TTL circuits. The input and output are also compatible with TTL circuits. In addition, the speed of NMOS is fast, power consumption is small, therefore, it has developed rather quickly in recent years. In particular, medium- and large-scale circuits mostly utilize NMOS circuits. The main production plants are the Shangwu 14 Plant and the Beijing 878 Plant.

5. CMOS Circuit

The manufacturing techniques of the CMOS circuit are more difficult. Its production in China began rather late. But at present, our nation can provide more than 70 varieties, including such products as the 1-bit microprocessor, electronic watch circuit, analog-digital converter, locked phase ring and voltage comparer. Because of its minimum power consumption characteristic, it has been widely used in portable meters and electronic instruments in space flight. The main production plants are the Shangwu 14 Plant, the Third Beijing Semiconductor Devices Plant, the Fifth Shanghai Components Plant, the Nanchang 746 Plant, the Changzhou Semiconductor Plant and the Suzhou Semiconductor Devices General Plant.

6. Analog Integrated Circuit

This type of circuit includes various interface circuits and linear circuits. Interface circuits refer to circuits that perform electrical level conversion and signal conversion to adapt to load requirements and to realize different types of signal conversions, such as for peripheral drives, read-out amplifiers, analog-digital or digital-analog converters. Linear circuits mainly include various types of computational amplifiers, integrated voltage stabilized power source and time-based circuits. The computational amplifier is an important field of linear circuitry. The domestic integrated computational amplifiers include not only the general purpose types I, II and III computational amplifiers, but such products as low power loss computational amplifiers, high speed computational amplifiers, high precision computational amplifiers, high voltage computational amplifiers, single power source computational amplifiers, wide band computational amplifiers and low noise computational amplifiers have continued to emerge. The computational amplifier is used in analog computers for integration, differentiation, addition, subtraction,

multiplication, division, logarithms and exponential computations. It is also used in electronic equipment for precise measurements, power source control, communications, information processing, and as part of switches, amplifiers, comparers, source wave filters and function generators. It is a multipurpose integrated circuit.

The integrated voltage stabilized power source is one of the important products of the linear circuit. Its function is to control output voltage fluctuation to less than 0.1 percent when the voltage over the power network fluctuates or when the load changes so that a stable power source voltage can be provided across the power line or for the entire machine.

The 555 time-based circuit is a type of time control circuit, therefore it is also called a timer. Although the time control circuit can also be constructed using a gate circuit and a single state stable trigger, such a circuit is not as convenient as the 555 time-based circuit which has high precision, strong versatility and which is suited for several hundred types of applications. Almost all foreign semiconductor manufacturers have such products and the model numbers all include the three numbers 555. Because this type if circuit has a broad range of application, it helps to solve many difficult problems in past circuitry designs, and therefore its production value is very high, ranking third among linear circuits, next only to the computational amplifier and the stabilized voltage power source. The main production plants are the Beijing 878 Plant, the Qinan 749 Plant, the Beijing Semiconductor Devices Institute, the Sixth Beijing Semiconductor Devices Plant, the Fifth Shanghai Elements Plant, the Seventh Shangwu Plant, the Shanghai 8331 Plant and the First Wuxi Elements Plant.

7. Special Circuits

These refer mainly to the television circuits, radio circuits, circuits in recorders, circuits in electronic watches, computer circuits, audio circuits and microprocessor circuits.

There are six series of television circuits: (1) color television and large screen black-and-white television circuits (TA series); (2) first type of small screen black-and-white television circuits (P24 series); (3) second type of small screen black-and-white television circuits (Sanyo triple-circuit series); (4) first type of circuits imitating the West German 5010 color television circuit (X series); (5) the second type of circuit imitating the West German 5010 color television circuit (7CD series); (6) black-and-white television circuits (5G series). At present, the P24 television circuit can be batch produced. The main production plants are the Wuxi 742 Plant, the Seventh Shangwu Plant and the Fifth Beijing Semiconductor Devices Plant.

The recorder circuit is mainly a sound frequency power amplifier circuit. There are a total of four types, three of which are imitations of the LA4100, LA4101 and LA4102 products of the Sanyo Company of Japan. The other type is an imitation of the TBA810S product of the Fairchild Company of the United States. The output power is, respectively, 1W, 1.5W, 2.1W and 4.2W.

Audio circuits have just begun trial development and production in China. They mainly include the following: (1) frequency modulated and amplitude modulated medium frequency amplifier circuit; (2) frequency modulated stereo demodulator circuit; (3) sound frequency power amplifier circuit; (4) amplitude modulated receiver circuit system; (5) low noise sound frequency preset amplifier circuit; (6) multifunctional audio circuits.

At present, the development of foreign microprocessors is very rapid. They have developed from 1-bit, 4-bit and 8-bit processors to 16-bit processors, and 32-bit processors are being developed. The development of microprocessors in China is actively being carried out and the 1-bit, 4-bit and 8-bit microprocessor circuits have already been developed. The 1-bit microprocessor is an imitation of the American MC14500 single board processor. The major functions are to complete logical decisions and conditional decisions, to realize sequence control, conditional control, fixed time control, counting control, pulse input control and many types of program control. The 1-bit processor is manufactured by the CMOS technique. It has a low power consumption, its resistance to interference is strong, and its range of operating voltage is broad. The main production plants are the Fifth Shanghai Elements Plant and the Third Beijing Semiconductor Devices Plant. The 4-bit processor was developed by copying the SM-2 product of Japan. It is mainly used in engineering calculations, intelligent meters and simple controllers. At present, two series are being test produced using the P-channel silicon grid E/DMOS and the P-channel aluminum grid E/DMOS techniques, i.e., the 040 and the 041 series. According to the technical and technological levels in China, the 4-bit processor uses the multiple-chip structure, which is divided into the CPU_1, CPU_2, ROM, RAM and display oscillator. This is relatively easy to realize and it has a greater flexibility. According to our understanding, there are many types of foreign 4-bit microprocessors and, at present, there is no trend toward standardizing them. In recent years, foreign nations have widely utilized the CMOS technique. We will also develop the CMOS 4-bit microprocessor on the foundations of the P-channel E/DMOS. The main production plant is the Wuxi 14 Plant.

China has selected the two representative series of 8-bit microprocessors, the 8080 series by the Intel Company of the United States and the 6800 series by the Motorola Company. In China, they are designated as the 050 series and the 060 series. At present, they have been successfully test developed and whole processors have been assembled in China. There are 16 varieties of the 050 series and 7 varieties of the 060 series. These two series are single chip CPUs, but we have also developed a few interface circuits. The main production plants are the Fifth Shanghai Elements Plant, the Wuxi 19 Plant and the Changzhou Semiconductor Plant.

The above is a brief description of the production and development of China's integrated circuits. We are confident that, as science, technology and socialist buildup develop, scientific research and production of integrated circuits in China will surely realize even more rapid development and their applications will become broader.

9296
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SYMPOSIUM OF CHINESE SOCIETY OF MARINE , FRESHWATER CHEMISTRY

Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 13 No 1, 1982 pp 102-103

[Article by Li Peiquan [2621 1014 3123]: "Symposium on Oceanographic and Limnological Chemistry Is Held in Qingdao, Chemical Society of the Chinese Oceanography and Limnology Society Is Officially Founded"]

[Text] The Chinese Oceanography and Limnology Society held a "Symposium on Oceanographic and Limnological Chemistry" from 22 to 26 August, 1981, in Qingdao. At the same time, the "Chemical Society of the Chinese Oceanography and Limnology Society" was founded. Attending the symposium were nearly 100 delegates from 26 units subordinate to the Chinese Academy of Sciences, higher educational institutions, the National Oceanography Bureau, the Second Ministry of Machine Building, the Ministry of Health and other departments. A senior in the field of chemistry, Professor Liang Shuquan [2733 2885 2938], who is a member of the Academic Department of the Chinese Academy of Sciences, and Professor of Academic Chemistry Wang Mingde [3769 2494 1795] attended the symposium. Executive Assistant Director of the Chinese Oceanography and Limnology Society and Assistant Principal of the Shandong Oceanography Academy, Professor Hao Zongben [6378 1504 2609], delivered the opening remarks. Deputy Secretary of the Party Committee of the Oceanography Institute of the Chinese Academy of Sciences and Executive Assistant Director Comrade Yang Jingren [2799 2417 0088] enthusiastically expressed his support and congratulated those at the meeting. After the opening ceremony, the first board of directors of the Chemical Society of the Chinese Oceanography and Limnology Society was chosen by democratic discussion and election. The board consisted of 34 members. Ji Minghou [4764 2494 0230] served as chairman of the board, and Li Faxi [2621 3127 6007], Sun Yushan [1327 3768 0810], Wang Lijun [3769 7787 0689], Hui Jiayu [1920 0857 3768] and Mo Jinhuan [5459 6855 1854] served as vice chairmen. The conference chose the three professors, Liang Shuquan, Chen Guozhen [7115 0948 3791] and Shen Panwen [3947 3140 2429], as honorary chairmen. Professor Liang Shuquan reported on the problems related to the present progress in analytical chemistry at the conference. He pointed out that the individual emergence of emphasis on instrumental analysis and the neglect of chemical analysis in the present field of chemistry are incorrect. His remarks attracted the attention of attending delegates. Professor Ji Minghou reported on the activities of foreign nations in the study of oceanic humus. The report entitled "Microcosmic Research in Oceanic Chemistry" by Assistant Professor Zhang Zhengbin [1728 2973 2430] described in an overall manner the achievements in recent years of our nation's microcosmic research in oceanic physics

and chemistry. Other who presented reports at the conference included comrades Gu Hongkan [7357 1347 1030], Chen Banglin [7115 6721 2651], Ji Zhengxun [4764 2973 6064], Han Wuying [7281 0582 7751], Liu Quxia [0491 5900 7209] and Hu Wenying [5170 2429 5391]. They presented special topic reports on the distribution of trace amounts of metallic ions in water, extracting uranium from sea water, the Pb method to study the rate of sedimentation, deep sea surveying, chemical characteristics of lakes on plateaus and the water in Donghu in Wuhan. Attending delegates were greatly inspired. The conference received a total of 85 papers. After the conference, three groups were organized for group reports and discussion according to specific fields of specialization in geochemistry and physical chemistry, analytic chemistry and resources chemistry.

The analytic chemistry group presented 20 papers, and proposed many new methods and new instruments suitable for research in oceanographic and limnological chemistry. The delegate from the Shandong Medical Science Research Institute reported on the method of using the Ge(Li)γ spectroscope to directly determine nucleins, and he reported on the survey of the five types of nucleins (U, Ra, Th, ^{40}K and ^{137}Cs) found in the coastal sediments in Bohai jointly carried out by them and the Oceanography Institute of the Chinese Academy of Sciences. The development of the Hy-814 digital spectrophotometer by Xiamen University attracted a lot of interest among participants. In addition, innovations and improvements were reported by papers on many analytical methods, such as the use of cold atomic fluorescence to measure mercury; the use of extraction, vapor phase, spectroscopy, atomic absorption methods to measure trace elements in sea water, living organisms and sediments and sugars in ocean algae; the use of the automatic analyzer to measure the content of ammonia and nitrogen; the development of potassium and sodium ion selecting electrodes; fusion technique in sample processing and analytic methods of radioactive isotopes ^{3}H, Th, U, ^{131}I, ^{239}Pu, ^{210}Po in sea water.

The geochemistry and physical chemistry group presented a total of 22 reports. The reports on the application of the three-dimensional method to the atomic absorption method, and on the presence of dissolved forms of hydroxyl complexes and chlorine complexes of heavy metals in trapped water have definite theoretical and practical value. The conference also reported on the results of research in the distribution and the chemical forms of trace elements, nutritive elements, heavy metals, arsenic, isotopes, rare earth elements and organic farm chemicals in the bodies of organisms, in suspended granules, sediments, and bodies of water in Donghai, Nanhai, Dayehu, Jiaozhouwan, Zhujiangkou, Bohaiwan, Fozhiling Reservoir, Donghu and Honghu, as well as questions related to the draining of pollutants into the oceans and lakes and evaluation of water quality. Definite achievements have been made in the study of such organic substances as amino acids and organic carbon in sea water, and in the study of the separation of humus in sea water and fresh water and its complexes. These have been new fields of research begun for the first time in our nation in recent years.

The resources chemistry group presented seven reports. Good progress has been realized in overcoming the problem of the influence of temperature upon the adsorption rate in the improvement of the conditions for preparing the titanium adsorbent in the study of extracting uranium from sea water. In addition, more profound exploration was conducted in the study of the physical and chemical characteristics

and the mechanism of the adsorbent. The other papers on the preparation of magnesium sand from low boron sea water, the study of extracting bromine from sea water, and the study of property changes in agar gel all provided basic methods and information for production.

In the overall view, the content of the papers was rich. The depth and broadness of research had not been seen before. This indicates that the standard of research in our nation's oceanographic and limnological chemistry has been greatly elevated. At this conference, some research achievements resulting from mutual penetration of different sciences and mutual cooperation were seen.

The conference implemented the policy of "letting a hundred flowers bloom and a hundred schools of thought contend." The enthusiastic discussion, the honest conversation and the rich democratic atmosphere greatly impressed t[illegible]cipants.

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AUTHOR: Yi Min [0044 3046]

ORG: None

TITLE: "Scientific Symposium on Basic Problems (Concepts) of Laser"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 1, Jan 82 pp 17, 37, 52

ABSTRACT: On 5-15 Sep 81, A Symposium on Basic Problems (Concepts) of Laser was held in Taiping County of Anhui Province. The symposium was organized by the Department of Physics, Chinese University of Technology, after accepting a request by the Laser Specialty Committee of Chinese Society of Optics. Participants included 65 delegates representing 40 organizations all over the country. After 34 persons-speeches, it was divided into 2 groups for discussion, centering upon the following 8 categories: (1) Thermodynamic description of the laser process; (2) Nature and parameters of Light Amplification by Stimulated Emission of Radiation; (3) Threshold conditions of laser production; (4) Ultra-short pulses; (5) Physical mechanisms of laser production or high-coherence light radiation (including X-laser, etc.); (6) (6) Optical resonant chamber and its modulo distinction; (8) Coherence, isotopic phase, noise, and oscillation spectral line width; (9) Nonlinear optics. Viewpoints concerning these subjects exchanged at the conference are briefly mentioned.

AUTHOR: WANG Nenghe [3769 5174 7729]

ORG: None

TITLE: "Second National Optical Information Processing Symposium"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 1, Jan 82 pp 27, 47

ABSTRACT: The Second National Optical Information Processing Symposium, held on 8-13 Sep 81 in Qingdao, was organized by Beijing Institute of Physics, Changchun Institute of Optical Devices, and Shandong College of Oceanography, by the request of Chinese Society of Optics. A total of 81 delegates and 23 alternates attended, representing 50 organizations of the National Science Committee, Chinese Academy of Sciences, schools of higher education, and departments of industries. Of the 120 papers submitted, 80 were delivered during the meetings. Deputy Chairman WANG Zhijiang [3769 0037 3068] reported on the Current Condition and Prospects of Optical Data Processing and Deputy Director HUO Yuping [7202 0060 1627] of Hefei Plasma Rsearch Institute reported on Spatial Variable Coherent Light Exchange. Ten others also delivered reports. Compared with the First Symposium (1979 in Chengdu), both the quantity and the quality of the papers are better. The delegates unanimously resolved that the next symposium should be called in 1983.

AUTHOR: YI Min [0044 3046]

ORG: None

TITLE: "The First National Symposium on Laser Engineering Applications Held in Leshan of Sichuan Province"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 1, Jan 82 p 91

ABSTRACT: China's First National Laser Engineering Applications Symposium was held from 29 Oct to 3 Nov 81 in Leshan of Sichuan Province. Participants included 204 delegates from 10+ provinces and cities, and 6 invited reports and 108 submitted papers were read. They reflect the progress of research studies on applied laser devices in China. The intermediate and small power laser devices are developing in the direction of miniaturization. Progresses have also been made, in various degrees, in such aspects as laser range finding, graphic data recognition, solid mechanical testing, information transfer, heat treatment, etc. Judging from these papers, the level of laser engineering applications in China remains somewhat behind that of foreign countries. There are still few blanks and the progress of relatively complex items is rather slow. More efforts are definitely needed.

6168
CSO: 4009/297

AUTHOR: YU Baoyu [5713 1405 3558]

ORG: General Research Institute of Nonferrous Metals, Ministry of Metallurgical Industry, Beijing

TITLE: "The Chlorination Kinetics of Oxides of Fe. Mg, Ti and (Fe, Mg)TiO_3"

SOURCE: Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 4, Apr 82 pp 164-175

TEXT OF ENGLISH ABSTRACT: The equilibrium diagram for Fe-Mg-Ti-O_2-Cl_2 system at 1123K was constructed based on thermodynamic calculation, and then an attempt was made, by selective chlorination, to yield synthetic rutile from ilmenite with high Mg content (Fe, Mg)TiO_3. The chlorination kinetics of Fe_2O_3, MgO, TiO_2 and ilmenite have been mainly studied using Cl_2-CO and Cl_2-C at 400-950°C. It resulted in the chlorination process of simple oxide being under chemical reaction control, while that of ilmenite was dependent on the ash layer diffusion. It seems to be difficult to get a high selectivity of FeO, MgO to TiO_2 in the fluidized-bed chlorination of high Mg ilmenite (Fe, Mg)TiO_3 with solid carbon reductant due to the thermodynamic and kinetic limitations. The "low temperature effect" and catalysis of $FeCl_3$ found in the chlorination process were also discussed.

AUTHOR: ZHONG Xiang [6945 4382]
LIANG Juanqiu [2733 1227 4428]
YU Qinghua [0827 1987 5478]
et al.

ORG: All of the Changsha Research Institute of Mining and Metallurgy, Ministry of Metallurgical Industry

TITLE: "A New Chelating Extractant--H106"

SOURCE: Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 4, Apr 82 pp 221-234

TEXT OF ENGLISH ABSTRACT: The stability of a new hydroxamic acid type chelating extractant, H106, and its extraction chemistry have been investigated. After 50 extraction-stripping cycles its loss is very little, and after a long-term aeration test in HNO_3 medium its stability is satisfactory. In H_2SO_4 solution, Ga and Ge may be perfectly separated and recovered by co-extraction and respective stripping. The extraction of group IV or V elements in HCl with H106 was available at their own appropriate acidity.

The mechanism of metal extraction by H106 and the stability constants of extracted species have also been studied. H106 is a weak monobasic acid with superior stability and extractability. It forms internal complexing salts with metal ions

[Continuation of JINSHU XUEBAO No 4, Apr 82 pp 221-234]

under testing conditions through oxygen-oxygen coordination. The order of extractability of metal ions is in agreement with order of cumulative stability constants of metal complexes. It shows excellent selectivity in extraction under certain conditions. H106 gives very satisfactory results in recovery of Ga and Ge from H_2SO_4 leach liquor of residue of hydrometallurgical Zn refinery, and may also be used in the determination of micro-quantities of Ti as well as in many other fields.

9717
CSO: 4009/309

Underground Engineering

AUTHOR: TONG Linxu [4547 2651 2485]

ORG: None

TITLE: "Discussion on the Types of Underground Garages Suitable for China"

SOURCE: Chongqing DIXIA GONGCHENG [UNDERGROUND ENGINEERING] in Chinese No 2, 11 Feb 82 pp 8-13

ABSTRACT: In China, there has been very little experience concerning the advantages and shortcomings of various types of underground garages. For the purpose of deciding the type or types that are suitable for the actual condition of China, foreign experiences should be beneficial. From the point of view of application, there are pubic garages, special vehicle garages, and storage garages. From the construction point of view, there are the attached, detached, single story, multi-story, etc. types. From the way vehicles are transported in and out of the garages, there are graded and mechanically transporting garages. The reason for the construction of a very large number of garages in foreign countries is to provide temporary parking for private cars. At present, there are no private cars in China; therefore, there is no need to build public underground garages. The majority of Chinese cities are old, with no modern urban administrative measures and very narrow streets. Parking is becoming increasingly a serious problem. If underground garages are to be built at a very high cost, the possibility of using them as shelters during the time of war should also be taken into consideration. This paper introduces various foreign designs of underground garages, with comments concerning their suitability in China.

AUTHOR: ZHANG Kaixin [1728 7030 9515]

ORG: None

TITLE: "Technical Discussion Meeting on Single-Track Railway Tunnel Ventilation"

SOURCE: Chongqing DIXIA GONGCHENG [UNDERGROUND ENGINEERING] in Chinese No 2 11 Feb 82 p 19

ABSTRACT: Sponsored by the Bureau of Science and Technology of the Ministry of Railways, a Discussion Meeting on the Ventilation Technique of Single-track Railway Tunnels was held on 9-11 Dec 81. Participants included 25 delegates representing The Basic Construction Bureau, the Academy of Survey and Design No 1, 2, 3, and 4, the Bureau of Tunnel Engineering, the Southwest Research Institute of the Academy of Sciences, [all above of the Ministry of Railways] and the Southwest University of Transportation. Among the subjects discussed at the meetings, there are inquiry into the piston Action of a train in the tunnel, computation of ventilation requirement of single-tract railway tunnel, theory and experiment of vertical tunnel ventilation, experiment on vertical ventilation of individual sections of a long tunnel and the method of computation. Experiments and studies on the safety and energy saving aspects of curtain-type ventilation device, signal interlock devices, etc. are suggested. The discussion meeting was held at the Southwest Research Institute of the Academy of Railway Science and Technology, in Emei, Sichuan Province.

6168
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END

JPRS 80949

1 June 1982

China Report

SCIENCE AND TECHNOLOGY

No. 163

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1 June 1982

CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 163

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REQUIREMENTS REVIEW, PROGRAM DEVELOPMENT IN AEROSPACE MEDICINE

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 4, Apr 82, pp 33-35

[Article by Chen Zurong [7115 4371 2837]]
Zhang Lifan [1728 4539 5672]]

[Excerpts] Aerospace medicine is special branch of medical science which is devoted to the study of various medical problems encountered in aeronautical or space missions. Since the beginning of this century, the increasing demands of aerospce activities have motivated the evolution of aerospace medicine into an independent branch of science. Its main objectives are: to ensure the safety, well being, and comfort of flight personnel and passengers; to improve the work efficiency of flight crews to ensure the completion of aeronautical activities and space missions; and to participate directly in the development of aerospace technology.

The Status of Aerospace Medicine in China

Before the liberation there was essentially no progress in the field of aerospace medicine in China. The only activity was the establishment in 1932 of a training school for Air force military physicians. By 1948 the school graduated a little over 100 medical doctors. During the 32 years under the new Chinese government, specialized research and educational organizations, bed-side medical units, and an aerospace medical team have been estavlished. A significant number of military doctors and aerospace doctors have been successfully trained. Chinese scholars in the field of aerospace medicine have definite contributions on basic theoretical research, in the development of protective and rescue equipment, in the promotion of flight hygiene, and in the improvement of physical conditions of flight personnel. More importantly, a foundation has been established by this initial effort for future development in this field. However, one must recognize the fact that aerospace medicine in China is still considerably behind world standards; in most aspects it cannot meet the needs of China's developing aerospace activities. Therefore, we should review our practical requirements and initiate a carefully planned systematic development program in order to accelerate the modernization of aerospace medicine in this country.

3012
CSO: 4008/158

URANIUM LASER ANALYZER

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 6, 1981, p 13 (brief)

[Article by Bian Yousheng [0593 2589 3932]: "A Uranium Laser Analyzer Passes Evaluation"]

[Text] A meeting organized jointly by the Fifth Bureau of the Second Ministry of Machine Building and the Hangzhou City Electronic Instruments Bureau to evaluate the "JU-1 model" uranium laser analyzer was held in Hangzhou from August 10 to August 14. Fifty-five delegates from 34 units including the nation's geological departments, environmental protection departments, health departments and higher educational institutions conscientiously tested and examined the performance and technical specifications of the instrument, and they held demonstrations to analyze actual samples at the meeting. The delegates to the meeting carried out full discussion and unanimously agreed that the "JU-1 model" uranium laser analyzer developed by the Third Institute of the Second Ministry of Machine Building met the designed requirements in sensitivity (detection of uranium can reach 0.05 PPb), stability, and precision of measurement, and it has reached the level of similar foreign products. It has provided an effective analytical tool for the measurement of trace amounts of uranium in atomic research and development, geology, health and environmental protection and monitoring, and it has filled a gap in our nation. The meeting suggested that the Hangzhou Optical Electronic Instruments Plant organize trial production in large quantity to satisfy domestic needs.

9296
CSO: 5000/4022

APPLIED SCIENCES

CHINA'S BIOLOGICAL, METEOROLOGICAL ROCKETS

Beijing HANGTIAN [SPACEFLIGHT] No 2, 1982, inside front cover

[Photographs and Captions]

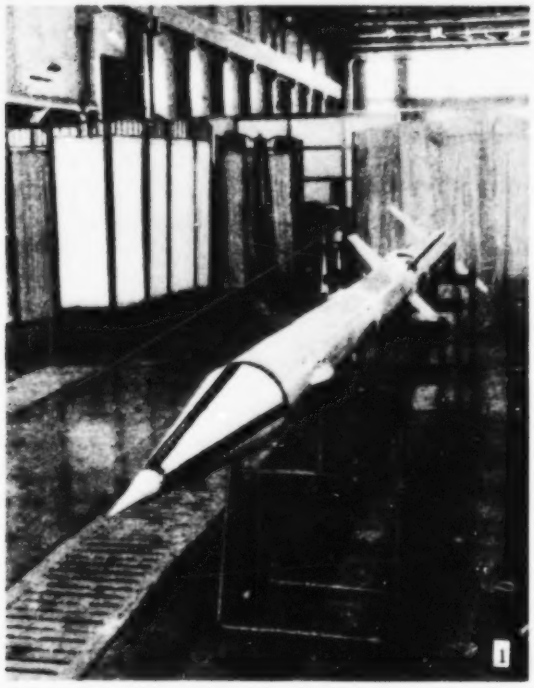

Fig. 1. Meteorological Rocket

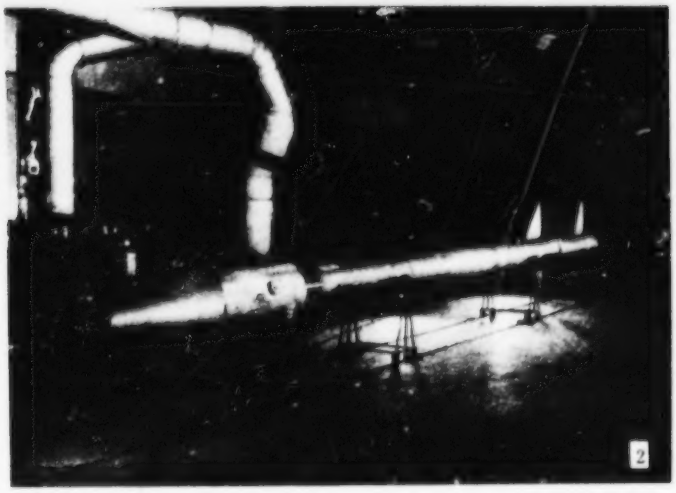

Fig. 2. Biological Experimentation Rocket

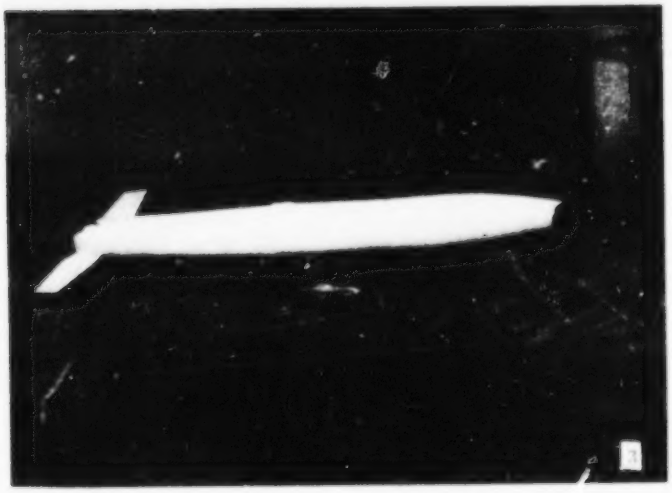

Fig. 3. Meteorological Rocket

Fig. 4. Meteorological Rocket Being Prepared for Launching

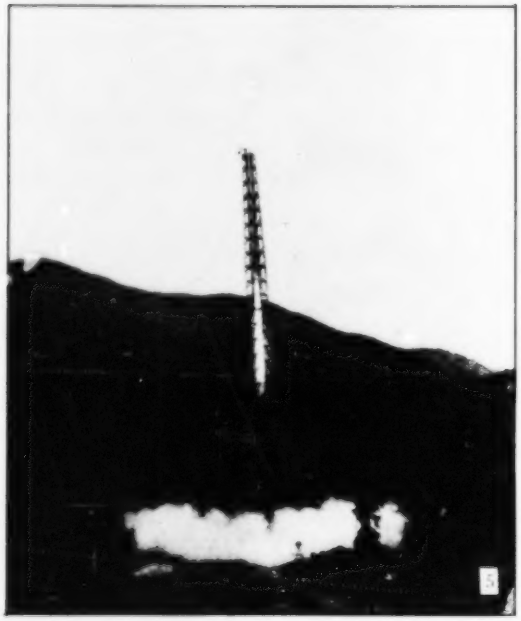

Fig. 5. Atmospheric Probe Rocket

CSO: 4008/154

SA 365 N DOLPHIN II HELICOPTER

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 4, Apr 82, pp 5-7

[Article by Staff Reporters of International Aviation]

[Text] On February 6, 1982, the sky was clear, but the air around the Capital's airport was filled with early Spring chill. Rows of passenger cars carrying over a thousand spectators from all over the country were heading toward one of the flight test fields in the airport. They all came here to witness the first exhibit flight of the first SA 365 N Dolphin II helicopter (No. 6013) produced in this country.

At 9:30 sharp, accompanied by the roaring sound of the engine, a white and blue "Dolphin" 6013 was lifted from the ground. At a height of approximately 5 m, the helicopter made a sharp 90° turn to the right and began to climb upward with great speed. In a short while, it began demonstrating a number of maneuvers: diving and dashing by the review stand; climbing vertically and then hovering at an altitude of 400 to 500 m; making a 90° right turn followed by a left turn, and suddenly "dropping" straight down; then gradually climbing backward again as the spectators applaud with admiration. During the 15 minute performance, over 20 maneuvers were executed one after another; they fully demonstrated the superior mobility of the "Dolphin" helicopter.

As soon as the flight exhibit ended, the spectators rushed toward the helicopter to congratulate the Chinese and French pilots who took part in this exhibit. We took this opportunity to arrange an interview with the planning director of the Technology Advancement Department of the Chinese Aeronautical Technology Import-Export Company (CATC), asking him about the joint Sino-French effort in producing the "Dolphin" helicopter. We also located the chief engineer of the Harbin Airplane Factory to ask him about the main features of the "Dolphin" II helicopter. Finally, we interviewed the co-pilot of this demonstration flight, and talked about his experience inoperating the "Dolphin". The contents of these interviews are summarized below.

Sino-French Joint Venture

The SA 365 N "Dolphin" II helicopter is a medium-size general purpose helicopter developed by the French Aerospace Company. It was evolved from the 365 C model and was granted the French Aviation Certificate in 1981. It is a technologically advanced product of the late 1970's. Recently, China adopted the French manufacturing techniques and began production of the helicopter as well as the engine. Prior to reaching a decision to select this model, the CATC had made a detailed analysis and comparison of the more advanced helicopters from various countries and had visited many companies abroad.

In July 1980, the CATC signed a technology transfer contract with the French Aerospace Comapny, which was later approved by both governments in October of that year. The contents of the contract were as follows: 1) France will transfer the complete set of technical procedures for manufacturing the helicopter and the engine to China; 2) France will initially deliver two completed helicopters to China; subsequently, it will deliver certain parts to be assembled in China; in time China will manufacture all the parts and assemble the entire helicopter. The "Dolphin" 6013 which took part in the demonstration was the first of the two helicopters which were flight-tested and certified in France and delivered to China on January 29 of this year. The contract also stipulated that as compensation China will return a certain quantity of manufactured helicopter parts to France. With this type of joint venture agreement not only can we learn the most advanced helicopter technologies and acquire the products with minimum time delay, but also save considerable foreign exchange by not directly purchasing the product from abroad.

Main Features of the Helicopter

The SA 365 N "Dolphin" II helicopter is considered a fairly advanced product among helicopters of a similar class. It is light-weight, and has high speed capability; its moving parts are reliable and have relatively long design lives; it is also easy to maintain and operate. Its design was based on the following guidelines: large passenger cabin easy entrance and exit; high cruising speed and large effective payload; long range with good economy; high degree of maneuverability and mobility; long operating life between repairs and ease of maintenance. In the development and production of this helicopter, many advanced technologies were incorporated. The main features of this helicopter include the following.

Composite Material Rotor: The rotor consists of 4 blades made of fiberglass and graphite. The rotor type is OA2 212-207; it has a twist of 10°, a blade-tip sweep of 45°; its turning efficiency is 0.75, and its nominal speed is 348 rpm. This type of composite material is strong and easy to machine; it was used on another

helicopter "Antelope" made by the French Aerospace Company. It has been reported that during an accident where two helicopters collided, the rotary blades of the "Antelope" chopped the other helicopter into two halves; the body of the "Antelope" was destroyed, but the rotary blades were essentially undamaged. Furthermore, metallic blades have poor corrosion resistance; they must be constantly inspected using microscopes to search for corrosion spots caused by sea water or chemical gas; if not discovered in time the corrosion spots may develop into cracks and cause the blades to fracture. Blades made of composite materials do not have this problem, which is a desirable property when operating over ocean surfaces.

The outer edge of each blade is covered with a stainless steel belt for protection against damage by debris. The four blades can also be folded backward to save parking space. The time required to fold the blades is approximately 10 minutes; for subsequent operation the blades can be directly unfolded without further adjustment. If one of the four blades is damaged, each can be replaced individually; the replacement blade can also be used without adjustment.

Star Shaped Flexible Blade Housing: This is one of the new composite material blade housings developed by France in the late 1970's. It has a star-shaped plate structure made of fiberglass and epoxide material. The plate arms have high damping rigidity and flexibility required for swinging motion; they also have visco-elastic damping devices, see back cover.

The main advantages of this type of blade housing are that it does not require lubrication or maintenance, and it is highly reliable. For example, if a metallic blade housing develops a crack, it is likely to be destroyed under the action of centrifugal forces, and break into pieces. The composite material blade housing on the other hand, will automatically stop operation under these conditions; furthermore, the cracked component will change color, making it easy to identify and replace. The composite material blade housing also has a simple structure, with only 64 parts, which is 4/5 less than the metallic blade housing of the "Skylark"; its weight is only 57 kg, which is 55 per cent that of the "Skylark". The "Dolphin" helicopter suffers little vibration during flight; this is partly due to the vibration-suppressing counter-balance weight in the rotary blade, and partly due to the special design of the blade housing. The reduced vibration level results in extending the useful life of each component of the helicopter, and the airborne instruments and equipment.

Culverted Tail Rotor and Non-Symmetric Vertical Tail: The tail rotor is located within the vertical tail (see back cover). It has 13 rotor blades; its diameter is 0.9 m, and its speed is 4700 rpm. The life span of the tail rotor blades is essentially

infinite, and there is no lubricated axle. This type of tail rotor is safer than the conventional type in that it will injure ground personnel, and the pilot need not worry about it hitting objects on the ground or tree tops when operating at low altitudes.

The vertical tail of the "Dolphin" has a relatively large area and uses a non-symmetric wing design, so that it can produce a certain amount of counter torque. Even when the tail rotor fails, this design will enable the helicopter to return to the airport at cruising speed, and perform a glide landing at a speed of 75 km/hr. This counter torque also aloows the helicopter to cruise at high speed with almost no power loss due to the tail rotor. Therefore, the fuel consumption of the "Dolphin" is less than helicopters with conventional tail rotors, and its range is correspondingly increased.

Propulsion System: This helicopter has two "Ah-ha-ya" 1C turbo-engines developed by the Tobomeca Company during the 1970's. The peak power of each engine is 710 hp; the power to weight ratio can be as high as 6, and the fuel consumption is only 250 g/hp-hr. The engines are equipped with an automatic power equalizing device, so that when one of engines fails, th other will automatically increase its power to an emergency level. Therefore, the "Dolphin" helicopter can perform a type-A take-off under full load conditions; conventional helicopters under similar conditions must reduce pay-load (passengers or fuel) to meet aviation regulations. The single-engine climb rate can be as high as 1.7 m/sec. In addition, the engine also has a fast-response advancing device connected to the blade pitch, which allows the power to increase from minimum to maximum in only 2 seconds.

The engine structure is of a molded design, which only has 5 unit components. To disassemble the engine into individual units only takes 8 minutes; to assemble the engine requires 24 minutes. When the engine is malfunctioning, it is only necessary to replace the unit which is defective.

Composite Material Body Structure: The body structure contains 59 per cent composite material, 28 per cent aluminum-Nomex sandwich structure, and 13 per cent conventional riveted aluminum structure. This type of structure not only results in a reduction in weight, but also in the manufacturing cost and aerodynamic drag. As a result of a series of weight reduction measures, the maximum ratio of take-off weight to empty weight can reach 1.95. Therefore, even though the exterior of this helicopter does not differ a great deal from that of other light-weight helicopters such as the "Skylark"-II or the Bell-212, its cabin capacity (5 m^3 plus luggage compartment) is larger, and its load capacity is comparable to that of the U.S. S-76.

Safety Features: The "Dolphin" helicopter has redundant hydraulic, fuel supply, and electric systems, some of which even have three-

unit redundancy. The dimensions od all mechanical components have relatively large tolerances so that in case of a failure in the lubrication system, the helicopter can continue to fly for 30 minutes, during which time the pilot can call for help or attempt an emergency landing. Other emergency measures include an emergency fuel dumping system which can release all the fuel in a few seconds, and emergency pontoons in case of forced landing over the ocean. The emergency pontoons are normally stored inside the body so it does not affect the flight speed; if the helicopter is forced to land over the ocean, the pontoons are automatically inflated within a few seconds (see title figure); at the same time two life boats each having a 10-person capacity automatically slide down from top of the cabin and after inflation stand ready at two sides of the helicopter. The fuel tank and the tail section of the helicopter are both sealed structures with good buoyancy characteristics. On conventional helicopters, the rotor cannot be started in a high wind exceeding 75 km/hr; otherwise the helicopter may topple over. The "Dolphin" II on the other hand is equipped with star-shaped blade housing and stopping blocks on the blades, so that it can be started safely even in strong wind with 100 km/hr wind velocit. Therefore, the "Dolphin" II can operate in a strong wind with intensity 7 over the ocean.

Maintainability: The "Dolphin" II helicopter generally requires a minor repair every 300 hours and a major repair every 2400 hours; the maintenance time for each flight hour is 0.47 hours, whereas some helicopters require as many as 11 hours. The procedures for disassembling and assembling mechanical parts are quite simple. By using the special tools in the luggage compartment and a small crane, a technician and the pilot can remove the four blades in 10 minutes (8 minutes for installation), disassemble the blade housing and the main speed-reduction unit in 1 hour 50 minutes (1 hour 13 minutes for installation), and remove the engine in 1 hour 30 minutes (1 hour for installation). The helicopter also has good accessibility. In addition to the two doors to the cockpit, there are four doors to the passenger cabin. On each side of the helicopter is a retractable stepping board; there is also a door to the luggage compartment. The main speed-reduction unit has many inspection windows through which the operating conditions can be monitored. The units which require frequent maintenance all have hinged covers; the entire nose section is also a hinged cover which in its open position will clearly reveal all the circuitry of the onboard equipment and instruments for easy maintenance (see back cover). Therefore, since the delivery of the SA 365 N last year and its predecessor SA 365 C in 1978, there has never been any accidents during operation.

Performance and Applications

The exterior of the helicopter and its dimensions are shown in Fig. 1. Its main performance parameters are listed as follows:

maximum gross weight	3850 kg
effective payload	1810 kg
maximum external load	1700 kg
maximum continuous power	594x2 hp
maximum speed	306 km/hr
cruising speed	260 km/hr
maximum range	882 km
maximum climb rate	7.7 m/sec
dynamic ceiling	4000 m
static ceiling	2350 m (with ground effect) 1200 m (without ground effect)
fuel consumption per km	1.06 kg

Compared with other helicopters of its class, the outstanding features of the "Dolphin" II are: larger payload, longer range, higher speed, and better economy. For example, the maximum range of the Bell-212 is 47 per cent less, that of the Bell-412 is 28 per cent less; the fuel consumption of the Bell helicopter is 1.5 kg/km whereas that of the "Dolphin" II is only 1.06 kg/km. Therefore, the higher initial cost of the "Dolphin" II is more than compensated by its long-term economy and its reliability. However, it must be pointed out that the SA 365 N helicopters currently being produced in France do not all meet the performance specifications stated in the Sino-French contract. The French Aerospace Company is currently taking measures to correct this situation.

The "Dolphin" II has many applications. There are about 50 selected services suggested by the French Aerospace Company. The basic model can be easily modified to perform special missions such as off-shore petroleum operations, transportation of personnel, off-shore support activities, rescue operations, elevated construction work, installation of high-voltage lines, aerial photography, geological exploration, oceanic patrol, and forest fire prevention. The U.S. Coast Guard recently ordered 90 "Dolphin" II's for its short-range retrieval operations; Canada and Saudi Arabia also purchased the "Dolphin" II for their petroleum exploration activities. The French Aerospace Company has also developed military versions of the helicopter such as the SA 365 F "Dolphin" II (see Fig. 2).

Operating Characteristics

The co-pilot who participated in this flight demonstration, comrade Ye Guanwei 5509 6034 4850 , had spent more than three months in France for flight training. Except for a few very special subjects, he had mastered most of the training courses. He considered the "Dolphin" II an outstanding helicopter: light weight, good aerodynamic design, retractable landing gears, and high speed--during a dive the maximum speed can reach 324 km/hr, which is quite unusual for helicopters of this class. Furthermore, the maximum range can reach 350 km; but if the fuel tanks

are loaded to full capacity, then only 6 passengers can be accomodated (normal capacity 10-14 passengers). Comrade Ye Guanwei was most impressed by the maneuverability of the helicopter. Compared with other helicopters he had flown, he considered the control system of the "Dolphin" II to be more complicated, but once familiar with the system, it becomes very easy to maneuver the helicopter. During this flight demonstration, the high degree of mobility allowed a number of difficult maneuvers to be executed with little control. However, high mobility implies poor stability; thus when the helicopter encounters a disturbance such as a wind gust, it tends to sway more than others. Comrade Ye did not notice any difference in the control characteristics between a culverted tail rotor and conventional tail rotors, but the improved safety of the culverted tail rotor gives the pilot psychological peace of mind.

3012
CSO: 4008/158

AUTHOR: ZHOU Xiwen [0719 6932 2429]

ORG: None

TITLE: "Analysis of Regulation Performance of a Variable Thrust Rocket Engine Control System"

SOURCE: Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 1, 31 Jan 82 pp 18-29

ABSTRACT: This paper introduces mainly a control circuit of variable pulse bandwidth to control 2 high performance electromagnetic valves. Through the variation of fluid flow volume, they change the pressure of hydraulic chamber of the injector to cause the needle valve of the injector to move up and down to vary the circulating area of the injector so as to control the variation of flow of the propellant to realize varaible thrust. The control system is composed mainly of the control circuit, the electromagnetic valve, and a thrust chamber having a variable area injector. Based upon the constituent parts and the actual operation process of this rocket engine, mathematical models of the various links are established, using the transfer function method to analyze the dynamic and static properties of the rocket engine control system. Major factors influencing its dynamic properties and static errors are explained. Diagrams are included to depict the operation principle and the structure of the various components.
This paper was received for publication on 21 Nov 80.

AUTHOR: FAN Jianfeng [5400 0494 1496]

ORG: None

TITLE: "Selection of Launch Time for Near-Earth Spacecraft With Mission of Visible Photograph"

SOURCE: Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 1, 31 Jan 82 pp 98-103

ABSTRACT: Using the equatorial coordinate systems to compute an arc of the earth capable of being photographed under visible light, the paper proceeds to obtain Ω_0, the initial time of a given visible arc of the earth before determining the local time of every point on that arc. The relationship between the time the satellite enters the orbit and Ω_0 is explained. In this manner, the paper establishes a set of formulas for selecting the launch time of a satellite to provide it a maximum photographical latitude or the best possible visible light to photograph a given area of the earth's surface.
This paper was received for publication on 17 Dec 79.

6248
CSO: 4009/303

AUTHOR: XIANG Dingpu [0686 7844 3877]

ORG: Research Institute of Geology, Gansu Provincial Bureau of Geology

TITLE: "Volcanic Rocks and Volcanism of the Qilian Mountains of China"

SOURCE: Lanzhou LANZHOU DAXUE XUEBAO [JOURNAL OF LANZHOU UNIVERSITY] in Chinese No 1, 28 Mar 82 pp 91-105

ABSTRACT: The structural units of Qilian Mountains may be divided from the north to the south into the following: (1) A geosynclinal fold on the margin of Hexi Corridor; (2) A eugeosynclinal fold belt with ophiolites; (3) A central uplifted belt; (4) A taphrogeosynclinal fold with ophiolites; (5) A miogeosynclinal fold. Five ancient ophiolite suits (Z_c-Z_j, ϵ_2, O_1, O_2, O_3) may be recognized. The Middle-Late Cambrian suit is observed only in the 4th unit of Lajishan and not to the south of it. The volcanic activities of Qilian Mountains are mainly central eruptions and a few crack eruptions. All volcanic rocks may be classified into the following: (1) The spilite-keratophyre series, such as the basic to acid volcanic rocks of the north; (2) The trachyte-feldspatite series, distributed only in the north, being rich in potassium; (3) The dacite-basaltic series, including Precambrian volcanic rocks of Lajishan and further south. This paper is mainly a summation of survey reports of Gansu, Qinghai, etc. and other related data of scientific research. Some maps and tables are included to help the narration.
This paper was received for publication on 8 Nov 80.

AUTHOR: LI Yulong [2621 3768 7893]
ZHANG Weixin [1728 4850 0207]
XU Shuying [1776 0647 7751]

ORG: LI of Lanzhou Research Institute of Seismology Chinese Academy of Sciences; ZHANG, XU of Department of Geology and Geography, Lanzhou University

TITLE: "Basic Neotectonic Characteristics of the Four Provinces of Shaanxi, Gansu, Ningxia, and Qinghai"

SOURCE: Lanzhou LANZHOU DAXUE XUEBAO [JOURNAL OF LANXHOU UNIVERSITY] in Chinese No 1, 28 Mar 82 pp 106-119

ABSTRACT: The 4 provinces of Shaanxi, Gansu, Ningxia, and Qinghai cover an area of 1.6 million km^2, amounting to 1/6 of the territory of China. In this region, the 3 geotectonic zones of China: the Xizang fault block, the Xiyu [Xinjiang and parts of Central Asia] fault block, and the China proper fault block merge while the south-north tectonic belt pierces through the middle to cause the geotectonic conditions to be extremely complex. Compared with other regions of China, the neotectonic movement here shares certain similarities, yet it is also obviously different. It contains 35 major active fracture zones, 3 graded plains, and more than 60 tectonic basins of various sizes. These units and their deformed shapes are described. There is also a table comparing the scale and speed of uplift of 18 mountain regions since the end of the Pliocene Epoch. This paper is largely an analysis of field observation data of many years, carried out by the authors and other colleagues.
This paper was received for publication on 6 Jan 81.

6248
CSO: 4009/307

AUTHOR: ZHANG Bin [1728 2430]

ORG: None

TITLE: "Contactless Silicon-controlled Sequential Control Device Successfully Made"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 2, 1982 inside front cover

ABSTRACT: With the cooperation of Liuzhou Municipal Rectifier Plant, the Guangxi Research Institute of Machine Industry has successfully made silicon-controlled sequential control devices in 3 types and 6 specifications. The prototypes have been used on the automated production line of rotary zinc plating in the Liuzhou Municipal 434 Plant, the automated dawn processing line of Nanning Municipal Meat Cooperative Plant, and the automated bearing inner ring machining of Nanning Municipal Bearing Plant. These production operations have proved that the devices meet design requirements. A certification meeting was organized in Nanning City on 10-13 Nov 81 by the Guangxi Zhuang Nationality Autonomous Region Science Committee and the Bureau of Machine Industry. All delegates to that meeting agreed that the devices have simple circuit designs, complete basic functions, and are of low cost. On such problems as the silicon-controlled stepper switch, separation of input signals, input logic computation, skip, delay, etc. the circuit design is rather unique. The switch signal allows direct input for various logic computations and has a relatively high direct output capability. The devices are not only inexpensive to make, they are also inexpensive to use, maintain, and service.

AUTHOR: None

ORG: The Secretariat, Society of Machine Industry Automation

TITLE: "Numeric Control Application Software Technology Exchange Meeting Held in Guangzhou"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 2, 1982 inside front cover

ABSTRACT: The Numeric Control Application Software Technology Exchange Meeting sponsored by the Chinese Machanical Engineering Society and the Machine Industry Automation Society, was held on 9-14 Jan 82 in Guangzhou. Participants included 60 delegates representing 46 organizations of the country. During the meetings, 14 papers were read and the information of 10 others was discussed, including such subjects as magnetic disk graphic information transfer program, etc. Numeric control application softwares include numeric system control softwares, automatic programming system softwares, and user application softwares, etc. The research on numeric control machines began in China in 1958 but the study on numeric control automatic programming did not start until 1965 while it was not until 1976 before studies on numeric control softwares were launched. In China, very few persons are engaged in software research. The ratio between software and hardware researchers is 1 : 10 and in foreign countries it is generally 1.5 : 1. With poor research techniques and long project duration, software research teams are urgently in need of reinforcement. The delegates offered many suggestions.

AUTHOR: ZHAO Huating [6392 5478 1656]

ORG: Beijing Municipal Bureau of Machine Industry

TITLE: "A Discussion on Machine Industry Automation"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 2, 82 pp 39-40, 23

ABSTRACT: Economic development depends mainly on raising the productivity of labor while automation is mainly to guarantee the quality of products and to increase labor productivity at the same time. The goal of automation is; therefore, mainly to obtain the optimal economic effect. It is not simply to advance technology. The developmental trend of the machine industry indicates that the high tide of mass production is gone. The sort of products that have been produced the same old way for decades and decades are dying out daily. New products and new types emerge all the time and the machine industry must be able to turn around quickly, to produce many products, and to achieve high quality and high efficiency of medium and small batch production. Methods for reforming production and expanding productivity must be contained within the machine industry itself. The author seeks to explain in the paper that the development of capabilities of automated production of medium and small batch products is a necessity dictated by the force of time and circumstances and is not just a blind pursuit of progress. Many domestic and European events occurring in the machine industry are cited to demonstrate this viewpoint.

6168
CSO: 4009/306

AUTHOR: WANG Zlin [3769 2737 2651]

ORG: Hot Working Division

TITLE: "Broad Temperature Range Germanium Resistance Pyrometer Certification Conference Called in Wulumuqi City"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82 p 18

ABSTRACT: The conference for the certification of the broad range germanium resistance pyrometer was called jointly by Xinjiang Weiwur Autonomous Region Bureau of Metrology and the Xinjiang Branch of Chinese Academy of Sciences. The instrument was designed and made by Xinjiang Research Institute of Physics Chinese Academy of Sciences. The China Academy of Metrology and the Xinjiang Research Institute of Physics proceeded with testing the instrument at 2-100 K standards. Before the conference got underway, the Low Temperature Office of the Chinese Academy of Metrology also called a meeting to test its low temperature standards. A total of 31 delegates representing 17 organizations attended the certification conference. All agreed that the short term repeat characteristic and the 2-month stability of the instrument are both 0.5 mk, which is the level of similar products of foreign countries. At present, Xinjiang Research Institute of Physics has the capability of producing it in small batches and is prepared to supply domestic needs for low temperature measurement.

AUTHOR: SU Hong [5685 9464]

ORG: Yunnan Provincial Research Institute of Metrological Testing

TITLE: "Successful Manufacture of Laser Fiber Gauge Measuring Instrument"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82 p 22

ABSTRACT: Yunnan Provincial Research Institute of Metrological Testing has, most recently, succeeded in making the JXC-1 laser fiber gauge measuring instrument. It utilizes the light diffraction theory, with laser as the light source, to proceed with noncontacting measurement. A certification committee was organized by Yunnan Provincial Science Committee, special schools of higher education, scientific research organizations, and applications departments to carry out technical examination of that instrument. Its technical properties were found to be satisfactory, with the following specific data: (1) The range of measurement: 0.03 mm $\leqslant d \leqslant$ 0.30mm; (2) Precision of measurement: When $d <$ 0.10 mm, the maximum error does not exceed $\pm$0.5 μm; when $d \geq$ 0.10mm, the relative error is not greater than 0.5 percent. The successful manufacture of that instrument provides the advanced means to measure small caliber metal filament, carbon filament, and chemical fiber in the precision requirements of national defense, scientific research, production, and foreign trade departments.

AUTHOR: LI Xin [2621 2946]

ORG: None

TITLE: "Certification Conference Approved the Laser Rockwell Hardness Reference and the Laser Surface Rockwell Hardness Reference"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82 p 34

ABSTRACT: The Laser Rockwell Hardness Reference and the Laser Surface Rockwell Hardness Reference, which havebeen successfully made by the Chinese Academy of Metrological Sciences, the branch of that Academy, Shanghai University of Science and Technology, Wuzhong Material Test Machinery Plant, Shanghai Research Institute of Machine Manufacturing Industry, Shanghai Scientific and Optical Instrument Plant, Wuhan Material Protection Research Institute, Shanghai Diamond Tool Plant, underwent certification in Chengdu City. Delegates, representing 40 organizations, and 60+ related specialists participated in the certification conference. Following serious discussions and inspections, all agreed that the instruments are accurate, stable, and technically advanced. Their indices have reached the internationally advanced standard. The precision of the laser rockwell hardness reference is $\pm$0.10HR and its long term stability is no less than 0.15HR. The precision of the laser surface rockwell hardness reference is $\pm$0.2 HR and its long term stability is no less than 0.3HR. They are approved as national base standards. Their participation in international comparison is suggested so that they may contribute to the unified measurement of Rockwell hardness, as the quality of these instrument warrants.

AUTHOR: LI Hui [2621 2585]

ORG: None

TITLE: "Three-phase Electric Energy Standard Verification Instrument Successfully Produced"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82 p 49

ABSTRACT: The three-phase electric energy standard verification instrument made by Liaoning Provincial Research Institute of Metrological and Testing Technology, with the cooperation of the Liaoning Provincial Scientific Instrument Plant, Shanghai Electrical Meter Plant, and Yingkou Radio Plant No 6. Advanced digitized display is adopted and the measurement precision is 5/10,000. This instrument not only fills a blank of China's electric energy measurement standard but also contributes to unifying measurement precision of electric energy toward developing energy conservation work.

AUTHOR: WANG Huaidao [3769 3037 6670]
XU Pingniu [6079 1627 3662]

ORG: Both of Office of Heat, Zhengzhou Municipal Institute of Metrology

TITLE: "RZZ-1 Thermocouple Automatic Verifying Instrument"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82 p inside back cover

ABSTRACT: At present, thermocouples are being checked manuallywith limited efficiency and precision. With the support of Zhengzhou Municipal Science Committee, the institute succeeded in making the RZZ-1. It has digital display, programmed control, and automatic print-out to realize automatic checking and automatic print-out of test results. The work efficiency is thus improved and the labor intensity is reduced. Furthermore, that instrument can also complete the automatic annealing and and cleaning procedures of thermocouples of industrial use. In Jun 80, the instrument underwent certification and was approved. The major technical indices and the work theory of the instrument are introduced.

6168
CSO: 4009/298

AUTHOR: CAO Xueren [2580 1331 0088]
FENG Yingjun [7458 2019 6874]

ORG: Both of the Baotou Research Institute of Metallurgy

TITLE: "Recent Picture and Outlook of the Use of Rare Earth Metals in Steelmaking in China"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 3, 1982

TEXT OF ENGLISH ABSTRACT: A general review of the use of rare earth metals (REM) in steelmaking in China for the past 20 years is presented.

Through a large amount of research and industrial trials, steels containing RE have been produced. Practice shows that REM additives improve transverse impact toughness and ductility of low carbon and low alloy steels, improve hot workability of high alloy steel and increase service life of resistance alloy wires, improve low temperature impact toughness and temper brittleness of structural alloy steels, prolonging fatigue life of steel products. REM also find application for improving as-cast structure and decreasing cracking tendency of steel castings and contincast slabs.

Earlier REM additives were simply thrown into furnaces or ladles, resulting in low REM recovery rate, ladle nozzle blocking during teeming, instability of steel properties and microdefects. The nature of nozzle blocking was studied and the measures

[Continuation of GANGTIE No 3, 1982]

for lightening or avoiding nozzle blocking were adopted. At present, methods of hanging REM rods in ingot molds and plunging the REM additives into ladles are in common use. The RE addition in the form of RE-oxide as the slag ingredient in the electroslag refining process has been proved successful and is now being used in production.

The mechanism of the effects of RE on steel properties is also described. To date, REM is chiefly added to control inclusion shape and to give a cleaning effect. The problem of the alloying effect of RE should not be overlooked, although solid solubility of RE in steel is very low. It might be thought that the segregation of RE at grain boundaries and the interreaction between RE and tramp elements or alloying elements in steel may give rise to certain effects to the properties of steel.

Finally, the outlook for the use of REM in the steel industry is also described.

9717
CSO: 4009/305

AUTHOR: LI Shimin [2621 0013 3046]

ORG: None

TITLE: "Condition of External Desulfurization of Panzhihua Steel Furnace"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 3, Mar 82 p 75

ABSTRACT: The molten vanadium, titanium, iron is a low silicon and high phosphorus, sulfur, iron mixture. At the same time, due to the fact that the sulfur content of the blast furnace raw material, pitch coke, increases year after year, the sulfur content of the pig iron also has the tendency of rising daily. The desulfurization burden for either blast furnace or converter is not economically or technically reasonable, however. Sometimes, it is even impossible. In 1980, the authors designed by themselves a set of blow desulfurization equipment which was installed for industrial experiment in 1981. With some continued improvements to the equipment, the blow system was made to operate normally and to produce a relatively satisfactory result. The desulfurization effects of 46 experiments are as follows: With 3-6, 6-7, and 8 kg/t of desulfurizing agent, the desulfurization rate is 50-74.3, 81-88.6, and 92.9 percent respectively. If ccc dry desulfurizing mixture is used, the desulfurization rate may always be above 80 percent. At present, a second round of experiments are being carried out to prepare the optimal formula for the desulfurizing agent, to appraise the economic benefits, and to provide design parameters for constructing large desulfurization stations at the steel mill.

AUTHOR: BAI Bingzhong [4101 0014 0022]

ORG: None

TITLE: "Experience Exchange Meeting on Dedusting and Environment Protection Techniques in Steel Industry"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 3, Mar 82 p 75

ABSTRACT: The Scientific and Technological Information Network of the Department of Steel Refining, Ministry of Metallurgy organized a dedusting and environmental protection technology in steel refining experience exchange meeting, which was held on 10-15 Dec 81 in Anshan. Participants included 74 delegates representing 55 production, scientific research, designing, and educational organizations. Discussions included some major aspects of converter smoke oxygen cap blowing purification and reclamation technique, wastewater and wastesludge treatment techniques, open-hearth furnace oxygen cap blowing electric dedusting technique, and their economic analyses. The delegates agreed that in China, the environmental protection technology in steel industry is a great deal behind the advanced level, but some obvious achievements have been made. These achievements and some proposals for possible immediate adoption, including noise control in steel refining shops, are briefly mentioned in the paper.

6248
CSO: 4009/305

AUTHOR: ZHU Guang [4554 0342]

ORG: None

TITLE: "A Meeting to Certify Molybdenum Plate Used in Silicon-controlled Rectifiers and Electric Vacuums Held in Benxi"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 1, Mar 82 p 80

ABSTRACT: The project of studying and making the molybdenum plate to be used in silicon-controlled rectifiers and electric vaccums was jointly completed by the Zhongnan Institute of Mining and Metallurgy and the Benxi Municipal Colored Metal Company Tunsten and Molybdenum Products Plant. The meeting to appraise the product sponsored by the National Colored Metal Management Bureau was held in Benxi on 24-26 Nov 81. Representatives of the 2 producing organizations delivered separate reports to introduce the research and manufacturing process. In consideration of the problem of poor strength, serious problems of brittleness and layered separation, surface blemishes, etc. of the molybdenum plates made in China, the Ministry of Metallugy directed the institute in 1979 to study the reasons for these shortcomings. Since then, 6 special reports on the project had been published. In Mar 81 the Ministry of Metallurgy signed a contract with the institute and the Benxi Colored Metal Company Tungsten and Molybdenum Product Plant to experiment with producing a molybdenum plate of better quality. The final product had been certified by Shanghai Rectifier Plant and Xian Rectifier Research Institute, etc. to be 90 percent useful in making silicon-controlled devices, compared with the 40-50 percent rate of the old plate. The new product is rated as 78.8 percent usable for making electric vaccums. All delegates to the meeting approved the certification of the product.

AUTHOR: LYU Haibo [0712 3189 3134]
ZHAO Muyue [6392 1970 1971]

ORG: None

TITLE: "The 1981 Annual Meeting of the Powder Metallurgy Committee of Chinese Metal Society Held in Changsha"

SOURCE: Shangsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 1, Mar 82 p 80

ABSTRACT: The 1981 Annual Meeting was held in Changsha on 7-11 Dec 81. Participants included 115 delegates representing 91 government, research, and producing organizations. The opening speech was delivered by LIN Zhifang [2651 1807 5364] Deputy Chairman of Hunan Provincial Science Committee. Prof HUANG Peiyun [7806 1014 0061] reported the work of the P/M Committee in 1979-81 and introduced the condition of the Sino-American Conference of Metallurgy. Before the meeting began, 145 papers had been received and a volume of abstracts was compiled. In addition, 51 papers were selected for delivery during the meeting. The Scientific Activity Committee discussed the planned activities for 1982. Lectures on P/M sintering theory and on heat equivalent static pressure technology are to be scheduled in Beijing and Yinchuan respectively.

6248

CSO: 4009/304

END

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NATIONAL SCIENCE PUBLICATIONS CONFERENCE HELD

OW240043 Beijing XINHUA Domestic Service in Chinese 0108 GMT 22 May 82

[Text] Beijing, 22 May (XINHUA)--At a recent national conference on research and planning of popular science writing and a recent forum on research in popular science readers, it was pointed out that at present, China's popular science writing is flourishing with unprecedented vigor. But at the same time, some works with evil intent and poor quality and some others whose contents are even erroneous or piosonous, have appeared. The conference maintained that it is necessary to sum up experiences and lessons, strengthen theoretical studies and ideological guidance, vigorously popularize science, recommend to the public fine popular science readers, and criticize sub-standard or erroneous works, thereby raising the quality of popular science readers to meet the needs of the four modernizations.

To raise the level of popular science readers, the China Institute for Research in Popular Science Writing under the China Association for Science and Technology plans to edit and publish, in the next 2 years, some 12 selected popular science readers in basic science, engineering science and technology, agricultural science and technology, medicine and public health, military science and technology, new and developing science and technology, popular science for children, scientific literature, scientific news, scientific broadcasting, science education films and foreign popular science readers. In addition, part-time research personnel and research personnel by correspondence will be engaged to study the selection of subjects and help promising writers industriously create high-quality popular science works.

It is learned that in recent years, each year over 80,000 medium-length and short popular science works have been published in the nation's various popular science papers or magazines or broadcast in radio popular science programs, and over 1,500 popular science readers have been published. Their readers and listeners run into the hundreds of millions. All this has played an active role in raising the scientific and technological level of cadres and the masses, promoting scientific and technological undertakings and building the socialist material and spiritual civilization.

Representatives at these meetings fully affirmed the orientation and achievements of popular science research over the past year and more, proposed and recommended many subjects for research in popular science

and enthusiastically shouldered the task of research. Research subjects included the study of the history of popular science and various works on popular science as well as special studies on activities of noted Chinese and foreign scientists and popular science writers in promoting science and technology. The China Institute for Research in Popular Science Writings will formulate research plans according to the importance and urgency of subjects and has decided to edit and publish a large collection of "popular science works and research," which will carry related research theses.

CSO: 4008/175

BRIEFS

BE[illegible]G TECHNICIANS' REFRESHER COURSES--Beijing, 23 May (XINHUA)--Beijing h[illegible]ablished a new college to provide refresher courses to scientific, te[illegible]cal and managerial personnel in the capital. Famous bridge expert Mao Yisheng is president of the college, which now has an enrollment of 2,400. Students come from among the 130,000 scientific and technical personnel working in institutions and enterprises under the Beijing Municipal Government. The college will provide them with professional knowledge and new developments in their fields of studies. Professors and teachers from Beijing's colleges and universities are invited to teach in the college. Preparations for establishing the college began in 1979. Some courses were started in the past 2 years and 1,800 students have already completed their studies there. [Text] [OW250439 Beijing XINHUA in English 1204 GMT 23 May 82]

CSO: 4008/175

VIEWS ON DEVELOPMENT OF SCIENCE, TECHNOLOGY AIRED

Beijing GUANGMING RIBAO in Chinese 5 Mar 82 p 2

[Article by Yang Zhenning [2799 2182 1337]: "Some Opinions on the Development of Science and Technology in China"]

> [Text] Editors' Note: This article is extracted from a recent letter from Professor Yang Zhenning, who agreed to its publication after making a few corrections. We hope that the article will be given serious consideration by scientists in this country, and we welcome opinions on the problems raised.

Research work in the physical sciences being conducted in the various systems in China is tending toward two extremes: it either overstresses basic research or overstresses product research (manufacture and improvement). It seems that development research, which falls between these two types, has not been taken seriously enough.

In terms of its contribution to society, basic research is a long-term investment whose results may perhaps strengthen social productive forces in 30-50 years or 100 years (high energy physics research is a classic example of basic research); product research is a short-term investment which mainly aims at results that can strengthen productive forces within 1-2 or 3-5 years (semiconductor institute research, as I understand it, is aimed primarily at product research). These two types of research certainly have their uses to society. But development research is a mid-term investment which hopes for results that will strengthen the social productive forces within 5, 10 or 20 years. I believe that this type of investment is currently the weak link in China's scientific research system.

In terms of research objectives, basic research does not concern itself with applications, while product research is clearly focused on one or two products or types of products; the objective of development research falls between these two types and lays particular emphasis on applications, but it is not limited to one or two types of products which are already known to be producible.

The relationships between these three types of research can be shown in the following diagram:

Basic research (long-term investment)	↔	Development research (Mid-term investment)	↔	Product research (short-term investment)

I believe that China needs a new, effective research center for developmental physics. Many scientific researchers of Chinese origin in the United States agree with this view.

The United States experience. In the United States today, basic research and development research are referred to together as "research and development" (R&D). Research is carried on primarily in universities and some national research institutions, while development is carried on primarily by research institutes associated with large corporations.

The following are some well-known corporate research laboratories (engaged primarily in development research): Bell Laboratories, General Electric Research Laboratories, duPont Laboratories, IBM Research Laboratories, Exxon Research Laboratories.

These laboratories have a great effect on United States industrial development, and total expenditures of development research are very great: According to statistics, the total operating expenditure of development research in the United States is about 10 times the operating expenditure of basic research. (See the article by A.T. Waterman, the first director of the National Science Foundation, in the AAAS publication "Symposium on Basic Research." Because the definitions of the two quantities being compared cannot be made entirely clear, this ratio cannot be estimated with any great accuracy.) This is a figure worth noting and considering: it indicates that other than product research, the bulk of United States scientific research expenditures go for development research.

Results in basic research gain great prestige and publicity, but the various corporations consider development research to be proprietary and are unwilling to publish it, so we in China may get the incorrect impression that basic research expenditures in the United States are greater than development research expenditures. In reality the situation is just the opposite.

The United States already had vigorous industrial development in the last century; but at that time the importance of research had not been recognized, so all research results were imported from Europe. It was the beginning of the 20th century before several large U.S. corporations began to recognize that this method would not do and created industrial research laboratories. Bell Laboratories, General Electric Research Laboratories and duPont Laboratories were all created during that period (see F. Seitz, "Science, Government and the Universities"; Seitz was head of the National Academy of Sciences before Handler). These laboratories not

only had a decisive effect on the United States' industrial development in this century, but even more important, their achievements made the United States' industry, commerce, banking and government recognize the importance of development research.

Support of basic research by society in the United States began only in the 1930's. This sequence of historical development puts the practical ahead of the theoretical and puts the near-term and mid-term ahead of the long-term:

Industrial development (began early in the last century)	↔	Development research (began about 1900)	↔	Basic research (began about 1950)

This was determined by economic laws and was not a matter of chance.

The same economic laws governed Japan's scientific and technical development. Japan's industrial takeoff in the last 30 years was based primarily on the results of development research and product research. There is very little expenditure on basic research in Japan.

The size of research centers. The United States company research centers mentioned above are very large. For example, today Bell Laboratories has a staff of 12,000 scientists and engineers, 3,000 of whom are PhD's (equivalent to more than 5 years of research experience after graduation from college).

The questions of what size a research center for developmental physics in China should be, what subjects it should focus on, with what plants, research institutes and universities it should cooperate, how it should train its research personnel, to what ministry or ministries it should belong (i.e., which ministry of machine building) and where it should be located are questions to which foreigners cannot contribute any useful opinions. A small conference should be held in China to study these questions in detail and propose a 5-year plan and a 10-year plan to be used in decision making.

Why are United States corporate research laboratories successful in development research? I believe there are three reasons:

a. The companies are thoroughly aware that the research laboratories are their lifeline for 5, 10 or 15 years hence, so that the laboratories are given sufficient funds and good equipment and their treatment is generally better than that in university or government organizations;

b. The laboratories' operating funds come from the corporations, and the ultimate value of their research results is determined by whether or not they can earn large profits for the corporations; this value concept is in accord with economic law;

c. The laboratory management (many of whom are scientists and engineers, although there are also people with financial and legal backgrounds) have many years of experience and are relatively well able to judge what topics will affect the company's development in 5 or 10 years.

U.S. NUCLEAR SCIENTIST LECTURES IN CHINA

Beijing GUANGMING RIBAO in Chinese 16 Feb 82 p 1

[Article: "Professor Ding Zhaozhong Makes a Scholarly Report in Beijing"]

[Text] On his current visit to Beijing, eminent U.S. physicist Professor Ding Zhaozhong [0002 5128 0022] ignored fatigue to give his scholarly report according to plan.

Executive Chairman of the CAS Presidium and Director of the Graduate School Yan Jici [0917 3444 1964] chaired the report meeting on the morning of 6 February. He said that Professor Ding was an internationally known physicist, an eminent professor of the Chinese Scientific and Technical University and a famed scholarly member of the Institute of High Energy Physics who has showed great concern for the development of high energy physics in his ancestral country, making one trip a year to describe worldwide development in high energy physics, has made an energetic effort to promote cooperation with Chinese physicists, and has trained many young research workers in high energy physics for our country.

At the meeting, Professor Ding used a multitude of illustrations and data to give a detailed description of the experimental plans made during the past 2 years by the group which he leads at CERN [European Center for Nuclear Research] for the up-to-date LEP electron-positron collision installation that is about to be built. More than 10 countries, including European countries, the United States and China, are represented in the group.

Drawing on his rich experience, Professor Ding gave a detailed description of the development of high energy physics experimentation, presenting some advanced, unique detector designs. He started by stressing that there must be a clearly-defined physical objective as a point of departure for planning of physics experiments. He stated that priorities must be clearly established, that the experiment must assure attainment of the main objective, and that it must have its own specific characteristics. In the LEP experiment, he believes that the detection and analysis of photons and of leptons, such as electrons and muons, is the main objective. Strong currents will be measured at the same time. In order to assure that the main objective will be achieved, Professor Ding stressed the necessity of using the most advanced techniques.

In his report, Professor Ding also gave some views on how to reorganize large-scale physics experiments. He said that for an experimental team to achieve results, it must have good personnel and the physicists must be interested in the work and have an objective; once an objective is decided upon, it must be maintained over dissenting views and there should be no haggling over other opinions or opposition; they must persist in the search for scientific truth in the experiment. A struggle must be waged to win time for the experiment and to give it top priority. In organizational work, the fault of "too many cooks" must be overcome and a high level of efficiency must be maintained.

Participants in the meeting included China's renowned physicists Zhang Wenyu [1728 2429 5940], Zhu Hongyuan [2612 3163 0337], Zhao Zhongyao [6392 1813 1031], Xie Jialin [6200 1367 7792], Hu Ning [5170 1337] and Tang Xiaowei [0781 1321 1218].

8480
CSO: 4008/120

NEUTRON TRANSMUTATION DOPING TECHNIQUE DEVELOPED

Beijing GUANGMING RIBAO in Chinese 10 Mar 82 p 3

[Article: "Technique for Neutron Transmutation Doping of Silicon"]

[Text] Last December, the Ministry of Metallurgy, the Second Ministry of Machine Building and the First Ministry of Machine Building jointly held an evaluation meeting on a technology for neutron transmutation doping of power switching transistors, at which it gave a favorable evaluation of a technique developed jointly by the Emei Semiconductor Materials Research Institute, the Nuclear Power Research Institute (Chinese Academy of Sciences) and the Xi'an Institute of DC Devices.

Neutron transmutation doping is a new technique developed in the 1970's which produces neutron transmission doped (NTD) silicon. The main technical characteristic of NTD silicon is that it is far superior to n-doped silicon produced by conventional methods.

The NTD silicon technique developed jointly by the Emei Semiconductor Materials Institute, the Nuclear Power Research Institute and the Xi'an Institute of DC Devices has already reached the batch production stage.

The evaluation meeting concluded that the process used for production of the silicon starting material was capable of stable production of high quality silicon monocrystals suitable for NTD doping, that the neutron transmutation doping technique used in a light water reactor was similat in quality to that performed in foreign reactors of the same type; that the use of NTD silicon involved virtually no change in conventional processes and in the stable production of switching transistors; and that the NTD silicon produced by the process was of good quality. NTD silicon is used primarily in the manufacture of high-power switching transistors, rectifiers and medium and low power triodes and diodes. Devices made from NTD silicon had good uniformity and considerably improved characteristics and yields.

Those requiring more information are requested to contact the Nuclear Power Research Institute, Chinese Academy of Sciences.

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CSO: 4008/120

NEW ELECTRONIC EQUIPMENT

Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 1, 1982 pp 43-44

[Article: "Introduction to New Products"]

[Article by Shou Gengru [1108 1649 1172]: "Questions and Answers About the S903 Antenna Amplifier"]

[Text] I. What is the use of the S903 Model VHF Antenna Amplifier produced by the Shanghai Radio Instruments Plant?

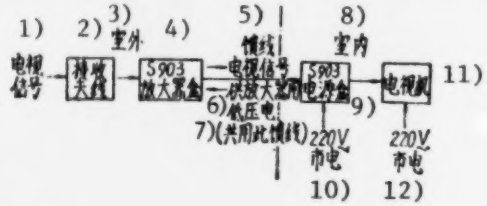
As the name implies, the S803 [sic] antenna amplifier is a television signal amplifier. It amplifies television signals received by the antenna and transmitted to the television set. It can visibly strengthen television signals severely weakened by the long distance between transmission and reception, and it can effectively compensate for the signal loss received by the outdoor antenna, transmitted over a long distance to the television set. It enables the signal to satisfy the requirements for signal amplitude by the television set. The quality of the image is improved. Background noise of the screen is reduced. The picture is clear and stable and the colors are bright.

II. Can the gain of the antenna amplifier be made higher?

The answer is negative. When we consider the gain of the amplifier, we must at the same time consider stability, especially the requirements of the low noise coefficient. This is because when the gain of the amplifier is too high, it will create self-excited oscillation and this destroys the normal operating state of the amplifier, and the quality of the image worsens. In addition, when the amplifier amplifies useful television signals, it must similarly amplify the noise that enters the amplifier and the internal noise of the amplifier. When the gain of the amplifier is too high, the value of the ratio between signal and noise (S/N) at the output end of the amplifier will drop. The quality of the television image will not improve too much. Therefore, the gain of the antenna amplifier cannot be too high. Full consideration has been given to the gain, stability and noise coefficient of the S903 antenna amplifier. It has a satisfactory noise coefficient, an ideal stability and a sufficiently large magnitude of amplification. The frequency range of the S903 is 45 to 230 MHz (1 to 12 frequency channels). The range of the input electrical level is 40 to 65 microwatts decibel (100 microvolts to 2 millivolts). The transmission impedance is 300 ohms or 75 ohms. The standing wave coefficiency is below 3.

III. When the amplifier box and the power source box are installed at different places, do they need an additional power feed line?

The amplifier box and the power source box of the S903 antenna amplifier installed at different places do not need an additional power feed line. This is because the power feed line of the amplifier shares the 75 ohm coaxial cable or the 300 ohm dual parallel lines originally used to transmit the television signals, and because the frequency of the television signals and the frequency of the power source are very different. Electrically resistant elements can be used for insulation. The S903 antenna amplifier uses this measure. Their connections are illustrated in the following diagram.



Key:
1. Television signal
2. Receiving antenna
3. Outdoor
4. S903 amplifier box
5. Feed line
   Television signal
6. Low voltage for amplifier
7. (Share this feed line)
8. Indoor
9. S903 power source box
10. 220V city power supply
11. Television set
12. 220V city power supply

IV. How is it installed?

After purchasing the S903 antenna amplifier, one can connect it as shown in the accompanying explanation and instruction diagram. The amplifier box can be affixed about 1 meter away from the antenna on the antenna pole by any type of clamp. Attention must be paid to treating the unbalanced 75 ohm transmission line and the 300 ohm balanced transmission line differently. Then, the switch of the power source box is thrown. The power source indicator light will light up indicating that the antenna amplifier has been connected to the power source.

V. Why does the S903 antenna amplifier have to be installed on the outdoor antenna pole?

The S903 antenna amplifier is designed for outdoor use. According to theoretical calculations, the total noise $F_{tot}(KT_o) = F_a + F_r - 1/G_a \cdot D$ according to the connecting order of antenna → antenna amplifier → long feed line → television set. According to indoor design, the total noise $F_{tot}(KT_o) = 1 + F_a - 1/D + F_r - 1/G_a \cdot D$. In comparison, when the noise index F_a of the antenna amplifier, the gain G_a of the

antenna amplifier, the internal noise index F_r of the television set, the loss D of the feed line are the same, the total noise of the former is much smaller than the latter. Therefore, the S903 antenna amplifier designed as an outdoor amplifier produces the best results.

VI. What is the actual result?

As long as it is installed according to the explanation and instruction booklet, generally speaking, its results are outstanding within a radius of 50 to 80 km from the television transmission station. The Jinshan County Government Hostel in the remote suburbs of Shanghai is 65 km from the Shanghai Television Station. After installing the S903 antenna amplifier, the hostel was able to view color television programs transmitted on channel 5 by the Shanghai Television Station for the first time. The picture was clear and the colors were bright.

[Article by Wu Yinan [0702 1355 0589]: "81-1A Digital Logic Tester"]

[Text] The 81-1A digital logic tester (inside front cover) is a portable multi-functional logic tester designed and finalized by the Computer Science Department of Huadong Normal University. It is suitable for use by colleges and universities and middle vocational schools in instructional experiments of digital circuits, digital logic, microprocessors and automation. It is also suitable for use by computer science research units and factories in circuit testing and testing medium and large-scale integrated devices. The product passed evaluation in July, 1981, by more than 20 higher educational institutions and related factories. It has begun batch production by the Jiangsu Qidong Changjiang Electronic Instruments Plant. It has produced good results in use by many higher educational institutions.

The 81-1A digital logic tester has the following characteristics:

1. It consists of nine blocks of advanced multiple socket circuit boards assembled in a building block manner for plugging in medium and large-scale integrated circuits for testing.

2. It has a 1 Hz-1 MHz pulsed signal source. The pulse frequency and pulse width can be adjusted.

3. It has an overload protected (automatic restoring) voltage stabilized power source (i.e., +5 volts, +10 volts, -5 volts, as mutually independent power sources).

4. On the face panel is installed an eight-digit logic electrical level switch and an eight-digit logic electrical levle indicator lamp with a drive.

5. It has a single pulse, clear "0" function keys and detachable logic test pen, digital display and a small multiple circuit switch.

[Article by Geng Ru [2577 0320]: "New S102 Model Combined Counter"]

[Text] The electronic frequency counter and the radio signal source are frequently used measuring instruments. In most applications, both machines have to be brought along. This is inconvenient to the user. Now, the functions of the two machines have been rationally combined together in the S102 multipurpose signal source/ frequency counter which has been successfully developed on a trial basis by the Shanghai Radio Instruments Plant and it has begun batch production. A new instrument with good performance has been provided for testing and instructional experiments at factories manufacturing television sets, radios, communication devices, schools and scientific research units.

The S102 can produce high frequency waves, amplitude modulated waves, frequency modulated waves and pulsed waves in separate frequencies between 1 Hz and 250 MHz. It can also directly measure the frequencies of radio signals from 400 KHz to 125 MHz. Its highest sensitivity is better than 10 millivolts. Reading of the frequency of the signal source is performed by the counter and is directly displayed while counting. The reading is clear and reliable, and the traditional imprecision caused by errors in graduations and reading errors of the signal source has been eliminated.

The external shape of the S102 instrument is shown in the diagram. Its dimensions are 220 x 78 x 280 (millimeters) and it weighs only 3.5 kilograms. It consumes 12 watts of electricity and its power supply can be alternating current or direct current.

[Article by Shou Gengru [1108 1649 1172] and Zhu Xiu [2612 0208]: "Aishi Brand Electronic Counter"]

[Text] The Aishi brand electronic counters designed and manufactured by the Shanghai Radio Instruments Plant have many varieties and a full range of functions. There are mainly the following kinds:

The PS-43 digital frequency counter that can directly count up to 100 MHz (inside back cover); the PS-44 frequency counter and the PS-45 general purpose counter (inside back cover) that can directly measure 300 MHz, 500 MHz respectively; the S800 series portable electronic counter. This series includes the S801, S802, S805 and S807 frequency counters (inside back cover) which can directly count 100 MHz, 300 MHz, 500 MHz and 700 MHz respectively. The sensitivity of the various electronic counters is all better than 100 millivolts. The daily stability of crystalline resonance is 3×10^{9}/day. Insertable accessories used in combination with the above series of electronic counters to expand their functions include: the PK-1A frequency converter that can widen the frequency testing range of the PS-43 to 1000 MHz; the CPS-101 time interval testing unit for expanding the testing functions of the PS-45 (time interval, cycles, frequency ratio); and the CPS-201 frequency expansion unit that enables the mainframe PS-45 to reach a highest testing frequency of 1 gigahertz. There are also the CPS-301, S-00001 pre-amplifiers which can improve the sensitivity of the Ps-44, PS-45 and S810 so that it becomes better than 10 millivolts, totaling 20 varieties of products.

The design of the S810 electronic counter produced by that plant combines printed circuit board techniques with all domestically manufactured elements in the high speed circuits. This has improved the direct frequency testing ability of our nation's electronic counters to 1 gigahertz. The S812 precise time counter used to measure the distance between an artificial satellite and the earth has measured the distance with an error of less than ±15 centimeters when combined with a laser radar to measure distances larger than 2000 kilometers. The instrument has a high resolution, a high precision, and its major technological specifications have approached the international level. The PK-2A frequency expander (inside back cover) that used a series of new techniques in circuit design, system structure and cavity processing can improve the upper limit of frequency measurements of a mainframe PS-45 connecting it to 4.5 gigahertz. There are also various portable and combined electronic counters that have been designed and manufactured according to the requirements of users, such as the S102 multipurpose signal source/frequency counter (inside back cover). The S102 combined instrument is light and versatile, convenient to use, and it is especially suitable for mobile users.

[Article by Li Fuyu [2621 1381 1342]: "Brief News on VMOS Field Effect Tube Development"]

[Text] The Semiconductor Physics Research Laboratory of the Shanghai Science University began to study the VMOS field effect tube in September of 1979. After over a year of efforts, it solved a series of key technical problems and successfully developed a new type of electronic device called the "longitudinal channeled VMOS high frequency and high speed power transistor" which possesses both the superior characteristics of the bipolar tube and the planar MOS tube. It passed evaluation as a scientific and research achievement in April of 1981. This device is tolerant to high voltage, has a small leakage, has a good transconductance linearity, and stable voltage when switched on. Also, ti does not produce a second puncture phenomenon. Its major and typical parameters are as follows:

Leakage source puncture voltage	$BV_{DS} \geq 70$ volts
Bias voltage tolerance between grid and source	$BV_{GS} \geq 70$ volts
Maximum leaking pole current	$I_{Dmax} \approx 500$ milliamperes
Transductance	$g_m \approx 50$-80 milliohms
Gate voltage value	$V_T \leq 2.5$ volts
Electrical resistance to conduction	$R_{On} \approx 10$ ohms
Power gain	$K_p \approx 9$ dB (400 MHz)
Maximum output power	$P_o \approx 2.5$ watts (400 MHz)
Switching time	$t_{On}t_{ff} \approx 2$-4 millimicroseconds

The VMOS high frequency and high speed power transistor can be used as a high speed switch, on-off switched power source, on-off amplifier, power switch, ultrahigh frequency wide band amplifier, pre-step of a receiver, radio frequency amplifier and as the large current junction in CMOS and TTL logic circuits. The shortcoming of the device is that the electrical resistance to conduction and the large current voltage drop are large.

9296
CSO: 4008/112

SCIENCE, TECHNOLOGY LEADS PRODUCTION IN MACHINE INDUSTRY

Xi'an SHAANXI RIBAO in Chinese, 7 Feb 82 p 2

[Article by Liu Yuxiang [0491 0056 7534]: "Shaanxi Heavy Machinery Plant Insists that Science and Technology Lead Production, Quality of Products Is Improved, and Production Value and Profits Continue to Climb Year After Year"]

[Text] The Shaanxi Heavy Machinery Plant insisted on the policy of science and technology leading production, greatly strengthened research of new products, expanded the scope of services and realized visible economic results. The production value and profits continued to climb year after year and a definite rate of development was maintained.

After the 3rd Plenum of the 11th Party Congress, this plant included scientific and technological work in the important daily agenda, and clearly proposed guiding policies in scientific and technological work for the whole plant, establishing the major tasks. Engineering technicians were assigned to the leading groups of the major production shops. The technology and science office was reorganized according to the principle of specialization. The system of technical management was perfected and over 200,000 yuan of capital raised by itself was used to add experimental equipment, strengthening the means of research and testing. A technical responsibility system headed by the chief engineer (technical deputy plant manager) was established. At the same time, the plant held an exhibition of scientific and technical achievements. These have encouraged scientific and technical personnel and collectives who have shown outstanding achievements in work, and greatly mobilized the enthusiasm of engineering and technical personnel and the masses toward science. Since 1979, they sent nine plant cadres to lead the engineering and technical personnel to visit north China, eastern China, the south central, northwest and southwest regions, and some localities within the province to survey over 200 users of the plant's products in the light industry, farm machinery industry, building materials industry and transportation industry. They also conducted technical and economic analysis of over 40 key users. Then they organized technical forces to strive toward better quality and to improve the inner quality and external quality of medium- and small-sized steel rollers on the original foundation, reorganized old products to lift the grades and, for replacement, developed 44 new types of steel, researched and tested 26 new types of products that were good in quality but low in cost, that had new structures and that were

easy to operate and repair. They have been well received by the users at each locality. The improvement in quality and the increase in products have enabled the production value and profits to climb continuously year after year and the enterprise has become active.

[Article by the Survey and Research Office of the Provincial Science Committee: "Baoji Petroleum Pipe Factory Greatly Develops Technological Renovation--In 2 Years It Has Realized 111 Renovation and Rebuilding Projects"]

[Text] The Baoji Petroleum Pipe Factory fully utilized presently available equipment, capital and materials to greatly develop technical renovation and technical improvements in improving the quality of products, reducing consumption, comprehensive utilization and in expanding varieties of products, and changed the serious passive situation of not having enough production tasks.

Baoji Petroleum Steel Pipe Factory mainly produces hidden arc screw welded steel pipes, nearly 50 types of steel pipes of different specifications and 2 types of welding agents. As the national economy is readjusted and as the battlefront of capital construction is shortened, the need for the products of this plant has drastically dropped and the production tasks have been seriously insufficient. Facing this fact, this plant relied on science and technology, began from within the enterprise and sought other ways by developing potential, renovation and rebuilding. The plant allocated 45 percent of the annual funds for renovation of the enterprise for use in technical renovation and technical improvements, and used its plant facilities to establish such major technical strengths of the scientific research institute, technical department and production shop in a relatively centralized fashion as a cooperative effort to study problems. All levels subordinate to the plant established leading groups in developing potential, renovation and improvement, and organized study groups. Engineering and technical personnel who were young and strong and who had experience were assigned to the front line of production to let them be in charge of concretely solving important technical problems in production. The plant also held 56 classes in various specializations to train backbone technical personnel to develop technology and renovation. Because the leadership paid attention and because the measures were correct, for the past two years the plant has realized 111 projects of renovation and improvements, and the quality of the products has visibly improved. In 1980, the percentage of products passing inspection reached 98.88 percent. First grade products amounted to 98.08 percent. The hidden arc screw welded steel pipes also received the national quality silver award. Last year the higher authorities issued a production plan to produce 40,000 tons, but the actual contract amounted to 62,000 tons. The production task increased from the original state of starvation to having too much work, and the passive situation of not having enough production tasks has been completely changed.

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SCIENTIFIC RESEARCH APPLIED TO PRODUCTION

Xi'an SHAANXI RIBAO in Chinese 11 Feb 82 p 1

[Article by Li Yuqiao [2621 3768 1564] of the Technology Department of the Provincial Economic Committee: "Being the Matchmaker Between Scientific Research and Production, Changing the Possession of One Unit Into Something 100 Units Can Use"]

[Text] The provincial economic committee and the provincial trade union have jointly organized technical cooperation between the factories and the technical cooperation office to apply scientific research achievements of scientific research units, universities and colleges and those enterprises with a strong technical force in production. This has changed the possession of one unit into something for use by 100 units and their strong life force has been demonstrated.

For over half a year, technical studies and transplants of technology have been organized especially for the production of 10 types of consumer goods of the light industry and textile industry. Nearly 100 enterprises solved more than 150 technical problems in production.

Our province now has 39 colleges and universities with strong scientific research strengths. There are more than 39 scientific research agencies that have relatively advanced instruments and equipment and that occupy a leading position in the nation. A fairly large number of them are nationally famous and unique specialized scientific research units. There are also over 200 large and medium backbone enterprises and a group of military enterprises that have relatively complete varieties and relatively strong technical strength, and the total number of scientific and technical personnel is over 195,800. They constitute our province's greatest advantage. But in the past, because the distribution of technical forces was not even, because the scientific and technical forces were not developed as well as they should have been, and because of a lack of channels and bridges for mutual communication between scientific research units and production units, scientific research and production were "two separate sheets of hide" and "flowers inside the wall produced fruits outside the wall." According to incomplete statistics, over the past 3 years 1,558 scientific achievements were realized throughout the province, but only 30 percent were applied and popularized in production. If this asymmetric situation between the scientific research strength and productive gain is not solved, it will be difficult for industrial production to shake away from the backward situation. Immediately after the

founding of this cooperative agency, the Provincial Technical Cooperation Office, it began studying technology, transplanting of technology, technical consultation and technical services to serve as the matchmaker between scientific research work and production and to bridge the gaps, and it has won the approval of all sectors and has been welcomed. For example, this office used the "801" dripping type thin layer carburization technique developed by the Provincial Machinery Academy at the Xi'an Bicycle Plant No 2. This has changed the long procedure, low efficiency, large energy consumption and high cost of the old kerosene dripping type carburization technique for carburizing the surface of bicycle axles. Consumption was lowered by 30 percent, the amount of electricity used was lowered by 26 percent, and the quality of products visibly improved. In the annual production of these four types of axle parts, calculating at 5.2 million pieces a year, the new technique can conserve over 16,000 yuan a year. After the close of the evaluation meeting for the two new techniques "801" and "803," the Provincial Technology Cooperation Office held a 4-day training class to popularize them among 32 enterprises in the light industry and textile industry. At present, the office has also accepted the commission of the State Economic Planning Commission and is preparing to hold short training classes to popularize the techniques in more than 150 key light industrial enterprises.

The Provincial Technology Cooperation Office has also organized the Tongchuan Technology Cooperation Office to help the Fuxian Brick Factory solve five difficult production techniques to fire bricks by positive pressure, to increase baking length, to adjust ventilation, etc., so that the percentage of imperfect products can be reduced from 80 percent to below 2 percent. Work efficiency has been improved 1.4 times. Over 10,000 yuan can be conserved a year in coal and electricity costs. A "dead factory" that was about to be closed down was rescued. During the past 6 months and more, it has also held 43 technical seminars of various kinds. Ten thousand persons attended. Fifty-one classes of various technical training classes were held and over 3,000 people participated.

At present, Xi'an, Baoji, Tongchuan and Xianyang prefectures and cities have already established corresponding technology cooperation organizations and have established 32 specialized technical cooperation teams in heat treatment, welding, casting, electronics, painting, and metal cutting with over 3,000 team members. The development of technical cooperation is very encouraging.

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CSO: 4008/107

ARTICLE DESCRIBES METHOD OF AUTOMATION

Beijing JIXIEGONGYE ZIDONGHUA [MACHINE BUILDING INDUSTRY AUTOMATION] in Chinese No 1, 1982 pp 42-43

[Article by Xu Tieling [1776 6993 7881], vice chairman of the Automation Branch, Hunan Provincial Machinery Engineering Society: "Taking the Road of Automation in the Chinese Way"]

[Text] I. In today's world of developed science and advanced technology, automation and modernization are like "twins." Various production machinery, weapons and equipment, scientific instruments, etc., and modern equipment are almost all automated or semi-automated. Therefore, the standard of automation has become an important indicator to measure the degree of modernization of industrial and agricultural production, national defense and science and technology.

The Party Central Committee has proposed developing four modernizations in a Chinese style, therefore we must also develop automation in a Chinese style.

I. The lesson that should be learned in popularizing the technology of automation

1. Detached from the situation in the nation and unilaterally seeking "unmanned" operation

Our nation has a population of 1 billion. The reserves of the labor force are huge. Under this situation, blindly pursuing the development of "unmanned" facilities of industrially advanced foreign nations, and even developing "unmanned shifts" which do not involve complex operating conditions, "telemetry, remote communications, remote sensing and remote control," etc., have frequently wasted massive amounts of capital just to eliminate a few workers. Even when a few workers have been eliminated, the whole employment structure has not changed along with progress in modernization. The few workers who have been replaced are still a burden for the enterprises.

Take the automation of a drainage pump at a certain mine as an example. Because the amount of water emerging from underground was large, five drainage pump stations were set up in the pits. Each pumping station had six to seven 300- to 400-kilowatt shallow water pumps. Three to four pumps usually operated continuously in three shifts. Each shift was manned by two workers. To realize

starting and shutting off the water pumps, automatic operation of the reserve pumps and automatic rotation of operation among the pumps, various forms of fluviographs and relay control devices were installed. For this, investment in each water pumping station increased by nearly 10,000 yuan. Calculating at a conservation of four operators per pumping station, each year nearly 5,000 yuan in wages could be saved. Theoretical estimates showed that investment in the automated facilities could be recovered in 2 years. At the beginning of the 1970's, the equipment began production one after the other. No visible benefits were gained in production and, because of many intermediate links, the chances of breakdown of the pumps increased and there were more troubles in maintenance. The workers and the higher authorities were both dissatisfied and operation had to be changed back to manual operation. As a result, the effort did not really conserve manpower and a lot of manpower and materials was wasted. According to our understanding, most of the automated water pumping stations similar to this one throughout the nation have already been abandoned.

Also, for example, a certain enterprise had three 6-kilovolt high voltage power distribution rooms. Each power distribution room was equipped with 20 GG-1A model high voltage switching panels. To pursue automation, it selected and used the SF58-25/A model line selector type remote control and remote communications equipment manufactured by a certain plant in Shanghai to realize "unmanned operation" of the high voltage distribution rooms. Investment in the equipment was 70,000 yuan. Calculating at 15 workers for the 3 power distribution rooms, each year nearly 20,000 yuan in wages could be saved and it was estimated that the initial investment could be recovered in three and one-half years. Therefore, it was decided that the "unmanned" operation plan would be implemented. The facilities were tested and handed over to the production units for use in 1972 and they were abandoned not long afterward. The reason was that the operation of the high voltage power distribution rooms had to be reliable, but the connections of the SF-58 model products were complex. There were many chances for malfunction and the manufacturing standard could not realize "unmanned shifts." For an enterprise, power transformation and power distribution stations are vital departments. The operation must also be simple. With this background, who can implement "unmanned operation" without worries?

2. Aiming too high and blindly pursuing "high grade, precision, pioneering" technologies

China's technology in automation is relatively backward. The gap in electrical controls is even greater. Foreign nations have already widely utilized computers and microcomputers have already penetrated into the various fields of automation.

Several years ago, the "important craze" was widespread among various enterprises. The competitively demanded that foreign nations provide computer-centered fully automated technology. For this, China invested a lot of technical effort for technical preparations. Many research units proposed "optimal control," "variable control" and other such high grade, precision and pioneering research subjects. Because the conflicts within the productive processes of various enterprises in the nation were not analyzed in depth and in detail, "test points" that were

separated from the actual productive levels were established. Everyone wanted to "improve output through optimal control" or "improve quality through variable control." A lot of manpower was invested and a lot of capital was spent (including foreign exchange), but technical and economic results could not be realized for a long time.

II. Taking the road of automation in the Chinese way

1. According to China's plans to readjust the national economy, the emphasis on automation at present should be in the light and textile industries, development of energy resources and conservation, improvement of environmental pollution and protection of production safety, and in industries that will benefit the opening of international markets. At the same time, the machinery industry, electronics industry, petrochemical industries should thoroughly implement the policies of renovation, rebuilding and developing potential. The function of presently available automation facilities should be fully developed. Efforts should be organized to study automation equipment that have problems so that such equipment can be used normally in production. Some old equipment must be technically rebuilt to realize ordinary automation following the principle of spending less money to do more work. Popularization and improvement of automation should gradually progress in order to catch up and surpass the world's advanced levels step-by-step.

For this, we must establish policies to develop automation in relative stability. We must make plans that suit the situation in the nation, that combine the near-term and the long-term goals and that are practical and feasible. We must establish an organized system that includes development by division of labor and popularization of automation technology.

2. Every way must be sought and efforts must be exerted to realize automation of production posts that endanger workers' health, such as toxic environments, dangerous environments and labor intensive environments.

For example, electroplating operations seriously endanger workers' health because of pollution of the environment by toxic and corrosive gases. Such an environment is suited for using automated production lines.

Also, for example, automation of punches in punching shops, automated molding and transport lines in casting shops, automated operating lines for pouring, automated packaging of white arsenic should be developed greatly to summarize and popularize the results of automation technology in time.

3. The energy problem is the foremost problem in China's building of the four modernizations. In the near-term, conservation must be placed at the foremost position. Improvement of technology and techniques and renovation and replacement of equipment can be promoted via conservation. Technical improvement and structural renovation of the national economy should be centered around conservation.

China now has approximately over 200,000 medium and small boilers in operation. Coal measurements and control, measurements of the flow of steam and its control and load regulators that guarantee economical operation of the boilers should be developed in a big way and popularized as quickly as possible. Necessary automated regulation of temperature, pressure and combustion in kilns and heating furnaces and such large equipment that consume energy must be implemented to guarantee that they operate in the best operating state and conserve energy.

We must develop and popularize devices that automatically compensate for power factors. During this period of nationwide shortage of electricity, conserving wasted electric power and providing more useful electricity will contribute greatly to the development of the national economy.

The automatic control devices, such as silicon controlled series governors, should be popularized in a big way. The ventilators and pumps and other such fluidic machinery used by China's light industry, textile industry, building materials industry, petrochemical industry and metallurgical industry generally require speed adjustments with a 30 percent range. The power of the series governors is only one-third the specified power of transmission type electrical motors. Practice shows that the difficulty in realizing this type of speed regulation is small and it is easy to popularize. The present emphasis in application should be in the realm of automatic control of temperature in textile mills, water pumps of urban water companies and the various enterprises, speed regulation of ventilators of power plants and cement factories, and automatic speed regulation of the slurry pumps at mines.

4. Automation technology is a comprehensive technology. Developing automation technology requires the joint efforts of scientific research units, design units, manufacturing plants and user factories and mines before good results can be realized.

Because automation technology is a science that spans many professions and, at the same time, because it is a technology that changes every day, it is difficult to adapt to the development in automation technology by fighting alone. Therefore, the Automation Society should serve a greater function in the popularization of automation technology. Through the society, specialists in all fields can gather together to establish a practical and feasible plan for the development of automation technology on the basis of surveys and research. Forces must be organized to take charge of making key breakthroughs by division of labor according to the characteristics of different periods and different professions. When the conditions are mature, product evaluation meetings can be organized and technological exchange can be carried out in time for mutual promotion and mutual improvement. Forces must be organized for different needs to strengthen technological development and popularization in factories and mines. Specialized technical training should also be actively developed.

Manufacturing plants must establish the concept of "seeking survival through quality, seeking development through varieties." They should clearly see the trends of technological development, grasp the different requirements of the users in time, and exert efforts to provide high quality and low cost products and

satisfactory service for users. The greatest hindrance to the popularization of automation technology is the overly high price of automation devices, unreliable operation, and the massive amount of maintenance work. For this, manufacturing plants must develop product standardization, generalization and serialization in time.

9296
CSO: 4008/116

BRIEFS

COMPUTERS, DEMOGRAPHY--China will use 29 computers to process the massive amounts of data and information of its third national census. At present, each province, city and autonomous region are actively building the somputer station. In the national census to be held of 1 July of this year, they will form a computer network centered in Beijing. The capital for 21 of these computers has been provided by financial aid from the United Nations Population Activity Fund. Eight computers have already been shipped and received. The remaining 13 computers will be shipped and will arrive in the near future. The eight computers purchased by China have already been installed separately in eight provinces, cities and autonomous regions and have processed data of local census test points. This is the first time China has used computers to process large-scale census data. To prepare well, over 1,000 people in computer software, hardware and operations and maintenance technicians have been chosen from all localities and they are now in training. One hundred thousand encoding and several thousand recording personnel will also be selected and trained to serve the computers. [Text] [Shijiazhuang HEBEI RIBAO in Chinese 2 Feb 82 p 3] 9296

FALSE COLOR DENSITY SEPARATOR--The photographs taken by satellites using multiple spectra remote sensing, photographs of isotope scanning in medicine, X-ray photographs of wounds suffered in industrial professions are all precious research data. But these are all black and white photographs and the images are not as clear and fresh as color photographs. At the end of last year, the Beijing Postal and Telecommunications Academy and the Atmospheric Physics Institute of the Chinese Academy of Sciences jointly developed a false color density separator which can change black and white photographs into color photographs. The photographs can display variations in topography and the position and degree of pathological changes in the human body in different colors. This facilitates accurage recognition of such changes. In the past, the false color density separator used in China was always imported. The false color density separator developed has reached the level of similar products of foreign nations in all its main functions. [Text] [Beijing BEIJING RIBAO in Chinese 9 Feb 82 p 1] 9296

PRECISION POLISHER DEVELOPED--Recently the YMP-1 precision grinder and polisher, developed jointly by the Rugao County No 5 Radio Plant, Jiangsu, and the Shanghai Institute of Technical Physics, Chinese Academy of Sciences, passed its technical evaluation. The evaluation results indicated that the machine documentation was rather complete, that it conformed to standardization norms, that the model was of novel and efficient design and compact in structure, that the quality of the parts and assemblies and of the entire machine met or exceeded the original design specifications, and that it could be used by a wide range of research units, universities and specialized schools and plant research laboratories for high-precision grinding and polishing of special crystalline materials and could be used in combination with X-ray diffraction equipment for polishing in alignment with different crystal directions. Potential users are requested to contact the Rugao (Jiangsu) County No 5 Radio Plant. [Text] [Beijing GUANGMING RIBAO in Chinese 10 Mar 82 p 3] 8480

94 GHz RADIOTELESCOPE DEVELOPED--The 94 GHz radiotelescope is mainly used to measure the absorption of radio waves of the 94 GHz frequency by the atmosphere and to conduct corresponding theoretical research. It can also be used for observing solar radio emissions and radio emissions of the moon at this frequency. The successful development of this radiotelescope has important significance in the development of national defense, remote sensing technology and research in radio astronomy. The sensitivity of this radiotelescope has reached the level of similar foreign equipment. The receiver consists of all integrated circuits. There are some new technologies which have also been used in this type of equipment for the first time in China. After actual observations, the performance of this radio-telescope is good and it has already received China's first group of actually observed data of atmospheric absorption of radio waves on the 94 GHz frequency. [Text] [Guangzhou YANGCHENG WANBAO in Chinese 1 Feb 82 p 1] 9296

CSO: 4008/107

LASER CONFERENCES HELD IN CHONGQING, DALIAN

General Applications, Popularization

Shanghai JIGUANG [LASER JOURNAL] in Chinese Vol 9 No 3, Mar 82 p 151

[Article by Ji Zhong [4764 6945]]

[Text] The National Laser Applications and Popularization Exchange Conference was held in Chongqing from 23-28 November 1981. Over 340 delegates from 270 units in 28 provinces, cities and autonomous regions, except the Xizang Autonomous Region and Taiwan Province, participated in this exchange conference. The conference received more than 400 papers and reports, and 144 of them were exchanged at the conference. The reporting meetings were held in five meeting rooms: (1) agricultural applications; (2) holography, measurements; (3) devices and components; (4) laser processing, heat treatment, inspection; (5) medical applications.

The reports received by the conference basically reflected the present situation and level of laser application in our nation. In industrial applications, the applied technologies of laser punching, laser welding, laser collimation, holographic non-destructive inspection were more mature, and definite economic results had been realized. Many watch component factories throughout China already used laser punchers to process gem bearings. The punching rate could reach 20 times per second. This reduced work procedures and improved work efficiency. Laser collimation realized achievements in the machine tool industry and bridge construction. When building the Changjiang Bridge in Chongqing, the laser collimator was used to collimate the bridge piers. This not only hastened the progress of construction, it also improved construction quality. The vertical error of the 70-meter tall piers of the bridge was only 2 millimeters. This was much smaller than the originally designed error of 8 millimeters. Holographic photography was used to solve some inspection problems that had been difficult to solve for a long time in production. For example, results were realized in the inspection of aircraft tires and in the detection of cracks in bomb shells and welded seams of liquefied petroleum gas canisters.

The laser demonstrator using a laser light source was used in educational demonstrations related to optics in the study of fundamental physics at middle schools and universities and it was welcomed by students and teachers. At present, our nation already has several fixed models of the laser demonstrator.

Medical workers reported on the clinical results of utilizing lasers. The laser is used a lot in clinical cases and it involves a broad scope. Reports included cases in otolaryngology and ophthalmology and stomatology, dermatology, gynecology and internal medicine. The large number of reports indicated that clinical use of lasers produced a definite result, and achievements were realized in treating some diseases with a low percentage of success with treatment by common surgical measures, such as excision of throat cancer and internal tumors in the liver.

The study of laser applications in agriculture was once developed on a broad scale in China, but such development dwindled over the past years. The delegates of the city science committee and the scientific and technical workers engaged in actual work discussed and exchanged views on the present situation in the popularization and application of lasers as well as the direction and policies of further popularizing the application of the laser.

During the conference, a laser science and technology achievement exhibition was held at the People's Arts Hall in Chongqing. Over 100 products produced by more than 40 research institutes, higher educational institutions and factories were exhibited. They included more than 30 commonly used laser devices, materials, components, stand-alone technologies and auxiliary equipment and various types of medical laser equipment. A large number of models and photographs showing the achievements of industrial applications was also exhibited.

Applications in Chemistry

Shanghai JIGUANG [LASER JOURNAL] in Chinese Vol 9 No 3, Mar 82 p 162

[Article by Ji He [0679 4421]]

[Text] The national conference on "Lasers in Chemistry" was held in Dalian City, Liaoning Province, from 12-15 November, 1981.

The conference was held in two phases. The first phase was the reporting conference which lasted a day and a half. A total of nine solicited reports were exchanged. They presented a relatively comprehensive discussion of domestic and foreign research trends and developments in laser chemistry, chemical lasers, the application of laser spectroscopy, laser induced chemical reactions, laser separated isotopes, application of lasers in chemistry and fluidic laser spectroscopy.

Afterward, special topic discussions by the following three groups were held: (1) chemical laser and gaseous and fluidic laser devices; (2) laser chemistry and microcosmic reaction dynamics; (3) laser technology in chemistry. The group meetings read more than 80 papers and conducted exchange and discussions on special topics in chemical lasers, laser induced chemical reactions, infrared multiple photon dissociation, laser separation of isotopes, laser spectroscopy and its application in chemistry, and new types of laser dyes. Profound and detailed fundamental research has begun in chemical lasers. Definite achievements

have been realized in light initiated, electron beam initiated and fluidic devices. Work in mathematical simulation of chemical lasers has begun. Research in the various means of testing is being carried out in depth. Welcomed results have also been realized in other realms of chemical lasers.

This was an academic exchange conference where chemistry and physics crossed paths and stimulated each other. Among the more than 140 delegates participating in this conference were scientific and technical workers in chemistry and scientific and technical personnel in physics. Their mutual cooperation and support will produce a profound and long lasting influence on this frontier science of lasers in chemistry.

9296
CSO: 4008/157

AUTHOR: DONG Liang [5516 0081]
ZHANG Xun [1728 6598]
MA Suzhen [7456 4790 3791]

ORG: None

TITLE: "The Influences of Nonlinear Restoring Moments on the Motion of Fin-stabilized Projectiles"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 2, May 82 pp 12-23

TEXT OF ENGLISH ABSTRACT: In this paper, we make use of the elliptic integral to solve the attack differential equation of a fin-stabilized projectile. The nonlinear restoring moments act on the fin-stabilized projectile which moves on a certain plane. Six conditions of stabilized periodic motions are given out and nonlinear restoring moments' effects on the projectile motion are detailed in this paper. The causes of the unexpected falling-down of mortar projectiles are discussed theoretically.

AUTHOR: DENG Shuyi [6772 6615 4448]
XU Zhimin [1776 2535 2404]
DU Lianfang [2629 6647 5364]
YANG Jianhua [2799 0313 5478]

ORG: None

TITLE: "Modulation Transfer Function of Human Visual System"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 2, May 82 pp 24-33

TEXT OF ENGLISH ABSTRACT: The threshold modulation for detection of rectangular wave gratings was measured as a function of spatial frequency for six observers at the ages of 19~21 by an apparatus which has been developed in our laboratory. Data were obtained for white light at eight retinal illuminance levels. The modulation transfer function was then calculated from these results. Based on the systems theory and spectral analysis, the modulation transfer function provides the resulting description of the performance of human eyes and can be applied to optical engineering and clinical ophthalmology.

AUTHOR: LIU Xiuji [0491 0208 7535]

ORG: None

TITLE: "On the Weight Growth of Main Battle Tanks in the Future"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 2, May 82 pp 42-53

TEXT OF ENGLISH ABSTRACT: The weight of the main battle tank increases continuously with the improvements in its three main performances--fire power, mobility and protection. This has become an acute problem for main battle tanks at the present time. In this paper, the objective regularity of the weight increase of main battle tanks in history is summarized, and the theoretical limit of the weight of tanks and whether the limit can be exceeded are discussed. The major aims of this paper are to analyze some directional foresights which will solve the problem of the weight increase of tanks from a long-term point of view. When the weight expands to a desperate situation, the final choice could be nothing but giving up some performances and giving prominence to other performances, which might lead to building different tanks for different uses. Some new concepts and arguments presented in this paper might help to clear up some questions and be useful as a reference in discussing the future of tanks.

9717
CSO: 4009/325

AUTHOR: TU Xuyan [3205 1645 7346]

ORG: Institute of Automation, Chinese Academy of Sciences

TITLE: "The Problem of the Structural Synthesis of the Most Economical Control Systems"

SOURCE: Beijing ZIDONGHUA XUEBAO [ACTA AUTOMATICA SINICA] in Chinese No 2, 1982 pp 103-111

TEXT OF ENGLISH ABSTRACT: In this paper, the ideas on the "Most Economical Control" and the "Most Economical Observation" are proposed, and the problem of the structural synthesis of the Most Economical Control System is discussed in detail. Starting from the multivariable "Harmonic Control" principle, the concepts of the "subtypes" of controllability and observability are introduced, and the related definitions and theorems are obtained. Based on them, the direct method of the Most Economical Structural Synthesis of linear time-invarying system is given and illustrated by two examples. Then, the open problems in the theory of the Most Economical Control Systems are mentioned.

AUTHOR: CAO Wenbin [2580 2429 1755]

ORG: Institute of Computer Technology, Hunan Province

TITLE: "Instantaneous Synchronous Method of Group Control in Real Time Remote Control Systems"

SOURCE: Beijing ZIDONGHUA XUEBAO [ACTA AUTOMATICA SINICA] in Chinese No 2, 1982 pp 126-135

TEXT OF ENGLISH ABSTRACT: This paper introduces a synchronous method of group control in real time remote control systems. Starting with the design of the structure of the instruction codes and pseudorandom codes in sequence, an instantaneous synchronous method of the system has been obtained in which the starting phase can float randomly.

The main features of this method are simplicity of circuit structure and reduction of time for synchronous tracking and synchronous holding existing in all the traditional syncrhonous methods, thus enabling the controlled objects to "respond rapidly and move accurately," and satisfy the requirements for the real time remote control.

9717
CSO: 4009/311

AUTHOR: ZHANG Daming [1728 1129 0682]
LIN Weisong [2651 0251 2646]
WU Zhangzhu [0702 4545 3796]
LI Yuanheng [7812 0337 0077]

ORG: All of the Seismological Institute of Guangdong Province

TITLE: "Free Vibration of Tall Shear Wall Structures"

SOURCE: Dalian DIZHEN GONGCHENG YU GONGCHENG ZHENDONG [EARTHQUAKE ENGINEERING AND ENGINEERING VIBRATION] in Chinese No 1, 1982 pp 33-39

TEXT OF ENGLISH ABSTRACT: Based on the model tests, the dynamic tests of full-scale structures and the theoretical analysis, a practical method for calculating the free vibration of tall shear wall structures, is presented in this paper. Using this method, the natural periods and modes of two buildings are calculated. The results obtained are nearly coincident with those obtained in the tests.

AUTHOR: None

ORG: Coal Mines Planning and Design Institute, Ministry of Coal Industry

TITLE: "Damage to Structures and Installations in the Underground Excavations of the Kailuan Colliery During the Tangshan Earthquake"

SOURCE: Dalian DIZHEN GONGCHENG YU GONGCHENG ZHENDONG [EARTHQUAKE ENGINEERING AND ENGINEERING VIBRATION] in Chinese No 1, 1982 pp 67-76

TEXT OF ENGLISH ABSTRACT: Typical damage to structures and installations in the underground excavations of the Kailuan Colliery, such as shafts, stations, chambers, main roadways, panel roadways, extraction faces and tunnel supports, during the Tangshan Earthquake of 28 July 1976 is discussed. Analysis of damage shows that engineering geological conditions, geologic tectonics, characteristics of surrounding rock, forms of support, layout of roadways and workmanship of construction have a direct effect on the damage to structures and installations in the underground excavations. The paper also shows that a lot of roadways and equipment were flooded due to sudden increase of flow of underground water and the breakdown of the power supply during the strong earthquake induced a lot of serious secondary damage. Suggestions have been proposed for the aseismic design of underground mines in the seismic area, and aseismic measures have been taken.

AUTHOR: LIANG Shufen [2733 3219 5358]
SUN Yibing [1327 0076 0365]

ORG: Both of Huazhong University of Science and Technology

TITLE: "Regressive Analysis of Hydrodynamic Coefficients for Horizontal Fin and Rudder Assembly in Submarines"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY] in Chinese No 2, 1982 pp 53-57

TEXT OF ENGLISH ABSTRACT: By a multivariate linear regressive analysis based on the data obtained from tests performed on a small series of models of submarine horizontal fin and rudder assemblies, a numerical analysis is carried out and formulas for hydrodynamic coefficients that can be used in designs are derived.

AUTHOR: SUN Yibing [1327 0076 0365]
LIANG Shufen [2733 3219 5358]

ORG: Both of Huazhong University of Science and Technology

TITLE: "A Numerical Method for Calculating Hydrodynamic Coefficients of Submarine Horizontal Stabilizing Fin-rudder Assembly"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY] in Chinese No 2, 1982 pp 59-66

TEXT OF ENGLISH ABSTRACT: Described in this paper is the calculation of hydrodynamic coefficients of a submarine horizontal stabilizing fin-rudder assembly by a numerical method of finite elementary solution. Calculation results are basically in agreement with those obtained by experiments. The effects of the aspect ratio, the swept-back, the taper ratio and the area ratio of the rudder itself to the whole assembly on the hydrodynamic coefficients are also studied.

9717
CSO: 4009/318

AUTHOR: GAO Yaolin [7559 5069 2651]
LI Keming [2621 0344 2494]

ORG: GAO of Shenyang Aeroengine Company; LI of Shenyang Aeroengine Research Institute

TITLE: "Effect of the Rear Stage Casing Treatment on the Overall Performance of a Multistage Axial-flow Compressor"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 2, May 82 pp 131-134

TEXT OF ENGLISH ABSTRACT: A trouble shooting test progress report on "C" compressor is presented. It mainly describes the test results concerning the effects of casing treatment and varying the stagger angle of the rotor blades at stages 7, 8 and 9 on the overall performance of a multistage axial-flow compressor. The test results show that the casing treatment of the rear stages is a very effective method to extend the stable operating range of the compressor at high speeds.

AUTHOR: YAN Ruqun [0917 3067 5028]
QIAN Zhaoyan [6929 5128 8826]

ORG: Both of Northwestern Polytechnical University

TITLE: "Investigations of Performance of Swept Cascade of Axial-flow Compressor"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 2, May 82 pp 135-137

TEXT OF ENGLISH ABSTRACT: The aerodynamic performances of swept cascade of axial-flow compressors are researched in this paper, and the calculating methods of the coefficient of total pressure losses, critical mach number and turning angle of the swept cascade are provided.

The flow features of swept blade along span direction are also studied, and the average wake contours and experimental data of various locations in span direction at given operating conditions are presented.

9717
CSO: 4009/321

AUTHOR: WENG Hongchun [5040 3163 2504]
ZHAO Yixin [6392 2011 6580]
PANG Zuozhang [1690 0155 4545]

ORG: All of Tienjin Municipal Public Health and Epidemic Prevention Station

TITLE: "Investigation of Epidemiological Characteristics of Typhoid Fever in Tienjin City in 1973-79 and Its Preventive Measures and Treatment"

SOURCE: Beijing LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese No 2, 20 May 81 pp 77-81

ABSTRACT: In 1973, there began a high incidence of typhoid fever in the city of Tienjin and some nearby rural villages. Following preventive and treatment efforts, the rate of occurrence began to fall to a normal level [pre-1973 level] in 1979. The 2 serious epidemics of typhoid fever in that city in 1958-64 and in 1973-78 are analyzed. The amount of rainfall does not appear to be closely related to the spread of the disease. In the 50's and the early 60's, drinking water appears to be the important source of the epidemic, but as the source of drinking water in the city continues to be improved in recent years, the rate of cases following the use of water for drinking or swimming has declined steadily. The majority of the cases belong to the type caused through daily contact (72.8-79.2 percent in 1973-79) primarily due to failure of strict isolation of patients. The major preventive measures adopted during the epidemic of 1973-79 are discussed and evaluated.

AUTHOR: TONG Xurong [0157 2485 2827]
SUN Yazhou [1327 0068 3166]
HOU Jun [0176 0193]
PANG Qifang [1690 0366 5364]
CONG Lianren [1783 6647 0088]
LIU Mingyang [0491 2494 7122]
QIN Baochang [4440 1405 2490]
YANG Xiufeng [2799 4423 7364]
ZHU Chun [2612 4783]
SHAN Changshou [1472 2490 1108]
HE Zimin [0149 1311 2404]
LIU Chongbo [0491 1504 0130]
GAO Jinlan [7559 6855 5695]

ORG: TONG, HOU, LIU, SHAN of Fushun Municipal Public Health and Epidemic Prevention Station; SUN, PANG, YANG, ZHU, HE, LIU of Research Institute of Virology, Chinese Academy of Medical Sciences; QIN of Fushun Municipal Suburban Public Health and Epidemic Prevention Station; CONG of Fushun Municipal Infectious Disease Hospital; GAO of Fushun Municipal Suburban Huiyuan Commune Hospital

TITLE: "Report of An Epidemiological Survey of an Outbreak of Type A Viral Hepatitis"

SOURCE: Beijing LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese No 2, 20 May 81 pp 89-91

[continuation of LIUXINGBINGXUE ZAZHI No 2, 1981 pp 89-91]

ABSTRACT: From the middle of Mar to the end of Aug, 1979, there was a small scale outbreak of hepatitis in Sandao Brigade in the suburb of Fushun City. The disease affected 82 persons. Epidemiological data, clinical manifestations, and pathogenic diagnoses all proved it to be an outbreak of A viral hepatitis, spread through group contact. The disease affected 7.88 percent of the population and the victims belonged to 57 families, amounting to 28.1 percent of the households in the brigade. Laboratory observation of feces of 4 patients disclosed that the virus may be detected from the feces from the end of the incubation period (the acute stage) all the way until after the appearance of jaundice. The titer and the duration of virus discharge varied from one individual to another in this group, however. All through this outbreak, the incubation period was short and the disease attacked chiefly children under 15 years of age. During the recovery stage, the positive rate of serum antibody reached 81.82 percent. Following treatment, all patients of this group were cured.

AUTHOR: HUANG Yulan [7806 3768 5695]
LI Junqing [2621 0193 7230]

ORG: Both of the 302 Hospital

TITLE: "Epidemiological Analysis of 1105 Cases of Malaria Observed in Beijing in the Recent 15 Years"

SOURCE: Beijing LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese No 2, 20 May 81 pp 95-98

ABSTRACT: Beijing is a region of unstable and low malaria incidence. Local physicians give little attention to this disease, but as it is the capital of the country, there are many domestic and foreign visitors. In the 15 years between 1965 and 1979, 1105 malaria cases were admitted at the hospital. A very large majority of these patients were visitors. The number of cases rose apparently after 1969 and 1971 was the peak year. Generally speaking, there were more cases in the summer; about 1/3 of the patients had had a history of malaria and 3/4 of the patients had lived in a region of high malaria incidence. Almost all these cases were tertian malaria but there were also a few falciparum cases. Most cases had typical attack symptoms and positive blood smear. Treatment with antimalarial drugs was usually effective. Among the antimalarial drugs used, the chloroquine plus Primaquine regimen was found to produce the best effects and to be the safest as well.

AUTHOR: None

ORG: Hunan Provincial Research Institute of Prevention and Treatment of Parasitism; Changde, Yiyang, and Yueyang Region Schistosomiasis Prevention and Treatment Center; Yueyang MunicipalShimen County Schistosomiasis Prevention and Treatment Hospital; Yuanjiang County Sihushan Region Schistosomiasis Prevention and Treatment Hospital

TITLE: "Epidemiological Survey in Three Varieties of Epidemic Loci of Schistosomiasis in Hunan Province"

SOURCE: Beijing LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese No 2, 20 May 81 pp 99-102

ABSTRACT: Since 1956, as the movement of prevention and treatment of schistosomiasis continued to progress, the condition of prevalence of this disease has changed. There are now 3 types of localities: (1) The epidemic ceased to occur and the prevention and treatment effects have become stabilized; (2) The area of distribution of oncomelania snails has shrunk and epidemics have become mild but there remain some victims and it is still possible for new cases to appear; (3) Snail distribution area remains large and epidemics severe. An area of each of these conditions was picked in 1979 to observe the epidemilological characteristics of the previous year. The survey results confirm that when the snail population is exterminated in an area,schistosomiasis ceases to spread there. The contents of the survey and an analysis of the result are reported.

AUTHOR: HUANG Baozhi [7806 1405 2655]

ORG: HUANG of Anhui College of Chinese Traditional Medicine; and Department of Epidemic Prevention, Hefei Municipal Public Health and Epidemic Prevention Station

TITLE: "Epidemiologic Analysis of Scarlet Fever of a 25-year Period in Hefei City"

SOURCE: Beijing LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese No 2, 20 May 81 pp 109-112

ABSTRACT: In the past, scarlet fever was mostly a disease of North China. It was seldom observed in the south except for a few scattered cases in the Changjiang Valley. In the last 2 decades, there have been a few serious epidemics of scarlet fever in Hefei City, however, with a rate of 41.77/10,000 population in 1959, 108.22 in 1973 (45.75 in 1974) and 43.49 in 1979. The data of 1973 and 79 indicate that the youngest victim is 6-month of age and the oldest is 56 with the peak in 73 among the group of 7-12 years of age. Surveys disclose that the initial cases are usually visitors from Shanghai, Henan, and Jiangsu while a simultaneous epidemic is reported in Bangbu City with the peak occurring 6 months before the epidemics in Hefei. These epidemics are; therefore, obviously related. The authors did observe children coming to school with a rash. They suggest that active cases should be strictly isolated although the disease is easy to diagnose and specific and effective drug is available for cure.

AUTHOR: ZHANG Yangxi [4545 2254 3556]

ORG: Liaoning Provincial Public Health and Epidemic Prevention Station

TITLE: "Automation of Processing and Miniaturation of Reservoir of Epidemiological Data"

SOURCE: Beijing LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese No 2, 20 May 81 pp 137-138

ABSTRACT: The application of computers in medicine has only been a recent subject but some studies on aspects of clinical diagnosis have produced some valuable results. This paper introduces the successful project,carried out by the author and colleagues, of using computer for statistical analysis of conditions of epidemics of infectious diseases. The general purpose computer TQ-16 made in China is used, with an operating speed of 110,000 calculations/second and a capacity of 32K. The program designed for the purpose of statistical grouping of fatal cases according to the time, the place, the age, and the occupation to produce various reports automatically is introduced. The advantages of making such reports with the computer are discussed.

6248
CSO: 4009/317

AUTHOR: YU Lishen [0060 4539 6500]
et al.

ORG: All of the Institute of Aviation Medicine, PLA

TITLE: "Prediction of Airsickness Susceptibility Among Flight Trainees with Coriolis Stimulation Test"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese Vol 7 No 2, Apr 82 pp 69-72

TEXT OF ENGLISH ABSTRACT: The Coriolis (or cross coupled) stimulation test was used to assess the susceptibility to airsickness of 7,048 flight trainees and pilots. In the testing, it was emphasized that not only the endurance time but also the extent of vestibulo-vegetative nervous responses, e.g., nausea, facial pallor and cold sweat, should be closely observed instead of observing any one of them. In comparison with the record of actual flight training, those trainees who endured the test less than 90 sec and showed intensive vestibulo-vegetative nervous responses were highly susceptible to airsickness. Of these, 71-78 percent were graded as severe, and they were disqualified from participating in flight training. The test was considered to be a definite and significant improvement in predictability over former tests.

AUTHOR: ZHAO Guozhong [6392 0948 1813]
et al.

ORG: All of the Institute of Aviation Medicine, PLA

TITLE: "A Preliminary Report of the Prediction of Flying Ability with EEG"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese Vol 7 No 2, Apr 82 pp 73-75

TEXT OF ENGLISH ABSTRACT: The EEG's of 625 physically qualified cadets of the Air Force Probationary Pilot Trainee School were analyzed and classified into types. A year later, before graduation from primary flight training, the cadets had their EEG's examined once more, and a careful analysis was made pertaining to flying ability. It was found that most of the subjects with high frequency α waves (12-13 c/s), classified as types II-2, IV-1 and IV-2, had had higher percentages of grounding and lower flying ability, and most of the subjects with medium frequency α waves (9.5-11.5 c/s), classified as types I and III, had had lower percentages of grounding and higher flying ability. Thus, it is considered that in selection of pilots, in collaboration with physical and psychological examinations, those subjects with medium frequency α waves (types I and III) should be given priority over those with EEG types II-2, IV-1 and IV-2.

AUTHOR: ZHAO Min [6392 3046]

ORG: Fourth Military Medical College, Xian

TITLE: "An Experimental Evaluation of Low Pressure Altitude Chamber Flight Profile Used for Indoctrination of Flying Personnel"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese Vol 7 No 2, Apr 82 pp 76-79

TEXT OF ENGLISH ABSTRACT: In order to improve our current chamber flight profile used in high altitude indoctrination, we studied the physiological effects of altitude hypoxia and decompression on 300 subjects. They were subjected to chamber flights with atmospheric pressure corresponding to a height of 11,000 m, inhaling either pure oxygen or nitrogen-oxygen mixture, the ratio of the latter corresponding to an altitude of 7,500 m. The experimental results confirmed that our new profile possesses many advantages, such as better acquainting the fliers with the symptoms of hypoxia and decompression, economizing manpower, material and time, etc. Moreover, this flight profile can also be used to check the fliers' hypoxic tolerance more efficiently.

AUTHOR: XUE Shanyi [5641 0810 4135]
AN Dingyi [1344 1353 0001]

ORG: Both of the General Hospital of the Air Force, PLA

TITLE: "Responses to Coriolis Acceleration in Airsick Pilots"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese Vol 7 No 2, Apr 82 pp 80-82

TEXT OF ENGLISH ABSTRACT: Two groups of pilots, one normal and the other with airsickness, were subjected to Coriolis acceleration with closed eyes. Their responses, including vertigo, palpitation, feverishness, weakness, salivation, pallor, sweating, nausea and vomiting, etc., were recorded. All data were collected and analyzed. All these responses observed were categorized into four degrees by the double-blind method combined with score recording. The responses in the airsick group were much different statistically than those of the normal group. At the same time we obtained a critical line of responses with which we are able to distinguish the abnormal from the normal, and also evaluate the individual adaptability in flying. Anyone who shows only mild responses can go on flying. On the other hand, those who show excessive responses beyond the critical line, and are identified or diagnosed as airsick, are certainly to be disqualified. When compared with the general rotatory test, the Coriolis method was more reliable. But the final evaluation must be considered with the history of motion and practical flying life of the subject undergoing the test.

AUTHOR: ZHANG Yansheng [1728 1750 3932]
WANG Mingxian [3769 2494 6343]
ZHAO Xuejun [6392 1331 6511]
XU Yikui [6079 5030 1145]
PIAO Kaidong [2613 0418 2639]

ORG: ZHANG, WANG, ZHAO and XU all of the Institute of Metal Research, Chinese Academy of Sciences; PIAO of Fushun Steel Works

TITLE: "Study on a New High Strength Heat-resisting Steel 45Mn31A13Mo2VWNbB"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 4, 1982 pp 45-52

TEXT OF ENGLISH ABSTRACT: This paper describes briefly the experimental results of Ni-Cr free austenitic high strength heat-resisting steels. The results show that there exists the possibility of developing an austenitic Fe-Mn-Al high temperature steel with high strength and a new experimental steel, 45Mn31A13Mo2VW NbB, has been successfully produced. Its structure and properties have been systematically studied by metallographic, electrolytic analysis, phase extrusion and mechanical testing methods. It is found that V_4C_3, NbC and Laves phase, etc., exist in this steel, with V_4C_3 being the chief strengthening phase.

The precipitation hardening of V_4C_3 combined with solid solution strengthening of Mo and W gives the steel high endurance strength exceeding that of A-286 in the

[Continuation of GANGTIE No 4, 1982 pp 45-52]

in the range of 700-800°C and approaching the level of Nimonic 80A. However, their resistance to oxidation and corrosion is poor, thus it is necessary to aluminize it to warrant long time service at relatively high temperatures. It is also pointed out that this steel may be produced on an industrial scale by inexpensive techniques and can withstand the commercial competition with Cr-Ni austenitic steel.

AUTHOR: MO Shuchi [5459 0647 6688]
QIU Chunrong [0092 2504 2837]

ORG: MO of the Central Iron and Steel Research Institute; QIU of Baotou Iron and Steel Company

TITLE: "A Comprehensive Study of the Production and Application of Fe-Nb-Mn Alloy"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 4, 1982 pp 53-58

TEXT OF ENGLISH ABSTRACT: Using an open hearth furnace slag containing about 0.5 percent Nb_2O_3 as raw material, a new Fe-Nb-Mn alloy containing 16 percent Nb, 5 percent Mn has been developed. It can be used effectively as a micro-alloy additive in steelmaking. The alloy effect of Nb in steel can be brought into full play in controlled rolling, and gives steel products a good combination of properties. A small amount of this additive in alloy cast iron will refine the matrix structure, improve the mechanical properties and prolong the service life. Furthermore, the recovery of niobium is stable (85 percent).

9717
CSO: 4009/320

AUTHOR: WANG Dajun [3769 1129 6874]
HU Haichang [5170 3189 2490]

ORG: WANG of the Department of Mechanics, Beijing University; HU of the Institute of Spacecraft System Engineering, Chinese Academy of Space Technology, and the Department of Mechanics, Beijing University

TITLE: "A Unified Proof for the Positive Definiteness and Compactness of Two Kinds of Operators in the Theory of Elastic Structure"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 2, 1982 pp 111-121

TEXT OF ENGLISH ABSTRACT: In the theory of leastic structures such as beams, plates and shells, we may define three kinds of spaces on the function space of all possible displacements: a Hilbert space of square integrable $\overline{U}_{ss} = L_2(F)$ which has $U_{ss} = D(A_s)$, the domain of definition of the "Structure Theory Operator" A_s, as its subspace; an inner product space U_{ps} whose norm equals the square root of the strain energy Π_s of the structure, together with its complete space $\overline{U}_{ps}$; and a Hilbert space $\overline{U}_{ks}$ whose norm equals the square root of the kinetic energy K_s of the structure. The operators $T_{ps,ss}: U_{ps} \to U_{ss}$ and $T_{ps,ks}: \overline{U}_{ps} \to \overline{U}_{ks}$ are then defined as mappings between the same elements in two different spaces.

The purpose of this paper is to prove that A_s is positive definite (which is equivalent to $T_{ps,ss}$ being bounded) and that $T_{ps,ks}$ is compact.

[Continuation of LIXUE XUEBAO No 2, 1982 pp 111-121]

On the other hand, the elastic structure may be dealt with as an elastic body with three dimensions. In three-dimensional elasticity, three corresponding kinds of spaces are defined on the function space of displacements: $\overline{U}_{se}$ and U_{se}; U_{pe} and $\overline{U}_{pe}$; and lastly $\overline{U}_{ke}$. The operators $T_{pe,se}$ and $T_{pe,ke}$ are similarly defined. It is known in the literature that the "Elasticity Operator" A_e is positive definite (i.e., $T_{pe,se}$ is bounded) and $T_{pe,ke}$ is compact for quite a wide range of boundary conditions.

Generally, there exist three connections in mechanics between the structural theory and elasticity: (i) The displacements in structural theory may be taken as the displacements in elasticity imposed with certain constraints described by the equality $u = T_{ss,se}w$, where the operator $T_{ss,se}$ maps U_{ss} onto a subspace U^*_{se} of U_{se}; (ii) In structural theory, usually there are some assumptions about the stress state, so that there exists a connection between Π_s and strain energy Π^*_e in elasticity theory with the same displacements. This shows that the operator $T_{ps,pe}$: U_{ps}-U^*_{pe} is bounded, the correspondence between the elements of $T_{ps,pe}$ being the same as that for $T_{ss,se}$; (iii) In structural theory, the contribution of some displacement components to the kinetic energy is often omitted, so we have a third connection between K_s and the kinetic energy K^*_e in elasticity, which shows that the operator $T_{se,ss}$, the inverse operator of $T_{ss,se}$, is bounded.

The following conclusions are obtained by two auxiliary functional theorems:

[Continuation of LIXUE XUEBAO No 2, 1982 pp 111-121]

For a structure with given boundary conditions, if the corresponding boundary conditions of the elastic body ensure the positive definiteness of the operator A_e, then the operator A_s with the given boundary conditions is also positive definite.

If such boundary conditions ensure the compactness of the operator $T_{pe,ke}$, then the operator $T_{ps,ks}$ is also compact.

In particular, these conclusions are applicable to composite structures as well as to shells with boundary conditions of various types, such as fixed edge, hinged edge, free edge, movable edge in the direction normal to the middle surface and their combinations.

AUTHOR: PAN Liangru [3382 5328 0320]
YAN Zhongmin [0917 6945 2404]

ORG: Both of the Institute of Mechanics, Chinese Academy of Sciences

TITLE: "The Viscous Effects on an AC MHD Power Generator"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 2, 1982 pp 195-201

TEXT OF ENGLISH ABSTRACT: This paper discusses viscous effects on the electrical performance and flow field of an AC MHD power generator. The analytical expressions for power factor, electrical fields and viscous incompressible flow in an AC MHD generator with channel height 2a and wave length λ are calculated to order $2a/\lambda$ by the usual method of expansion in powers of $2a/\lambda$. It is found that viscous effects have to be taken into account when ε is not quite small and equivalent Hartman number $M \sin (\frac{2\pi}{\lambda} x - \omega t) \leq O(10)$.

9717
CSO: 4009/310

AUTHOR: ZOU Xingchang [6760 5281 7022]

ORG: Department of Marine Physics

TITLE: "Analysis of Data from Passive Microwave Remote Sensing over the Jiaozhou Bay, Qingdao"

SOURCE: Qingdao SHANDONG HAIYANG XUEYUAN XUEBAO [JOURNAL OF SHANDONG COLLEGE OF OCEANOLOGY] in Chinese Vol 12 No 1, 1982 pp 21-26

TEXT OF ENGLISH ABSTRACT: The passive microwave radiometric images were taken from the test field over Jiaozhou Bay, Qingdao, with an airborne 3-centimetric imaging microwave radiometer in September and October, 1979. In this paper, we present some microwave radiometric pictures and analyze the remote sensing data obtained, with a brief discussion of oceanography microwave remote sensing. From these pictures and analysis it is shown that the distribution of the brightness temperature of salt field differs distinctly from that of estuarine environment.

AUTHOR: None

ORG: Laboratory of Ocean Optics, Department of Marine Physics

TITLE: "Analyzing the Results of an Airborne Test for Remote Sensing over Jiaozhou Bay"

SOURCE: Qingdao SHANDONG HAIYANG XUEYUAN XUEBAO [JOURNAL OF SHANDONG COLLEGE OF OCEANOLOGY] in Chinese Vol 12 No 1, 1982 pp 27-34

TEXT OF ENGLISH ABSTRACT: The Shandong College of Oceanology organized an airborne test of remote sensing over Jiaozhou Bay in the last week of September, 1979. This paper mainly discusses our analytic methods and analyzes data and information gained from our test. We have analyzed data from this test, and obtained several results: (a) Hydrologic information of the sea, (b) Pollution of the sea, (c) Coastal geomorphology, (d) The rmal radiation image at night, (e) Microwave radiation from the sea surface.

AUTHOR: HE Mingxia [6320 2494 7209]
LIU Zhishen [0491 2535 3088]
QIU Zhen [3061 4176]

ORG: All of the Department of Marine Physics

TITLE: "Real-time Optical Information Processing for Ocean Remote Sensing Images"

SOURCE: Qingdao SHANDONG HAIYANG XUEYUAN XUEBAO [JOURNAL OF SHANDONG COLLEGE OF OCEANOLOGY] in Chinese Vol 12 No 1, 1982 pp 35-38

TEXT OF ENGLISH ABSTRACT: This paper describes a white light image processing system using a new optical method for oceanic remote sensing images. Landsat photographs and airborne remote sensing images of Chinese coastal areas have been processed. The experimental results show that this technique is very appropriate for practical application in coastal zone survey, for example, for length of coastal line, shoal patch in shallow sea areas, silt distribution of river mouth, ocean surface pollution as well as analysis of sea current and ocean waves.

9717
CSO: 4009/312

AUTHOR: QIN Shaozong [4440 4801 1350]
LIU Guangyuan [0491 0342 3293]

ORG: Both of the Institute of Chemical Metallurgy, Chinese Academy of Sciences

TITLE: "The Applications of Optical Fiber Transducer in Measurement and Display"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 2, 1982 pp 129-136

TEXT OF ENGLISH ABSTRACT: This paper describes the results of the experimental study in which optical fibers are used as a transducer to measure the velocity of solid particles, the porosity in two-phase flow, the phase surface in the flow medium and to display the images of the solid particles in the reactor. The structures of several types of optical fiber probes are introduced and a statistical distribution device for measuring bubble diameter and velocity is designed.

This paper also gives the diagrams of probability density distribution which was obtained by applying the random signal statistical method to analysis of the experimental data.

AUTHOR: LIANG Fuping [2733 4395 1627]

ORG: Tianjin University

TITLE: "An Investigation of Diameter Measurement of Superthin Wire with Laser Diffraction Waves"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 2, 1982 pp 211-218

TEXT OF ENGLISH ABSTRACT: This paper introduces the method of using laser diffraction to measure the diameter of superthin wire and studies the problems of small signals, weak energy and many disturbances that appeared in the diffraction measurement of superthin wire. According to the theoretical computation of the distribution of energy of the diffraction pattern and the symmetrical principle of energy, calculation and analysis for how to set the receiving diaphragm is made. Based on the result of theoretical analogous computation by computers, an "analogous method of moving the detector" has been submitted for calibration. The method and its theoretical and experimental curve have been analyzed and introduced.

9717
CSO: 4009/323

AUTHOR: ZHU Jimao [2612 4949 2021]
ZHAO Yuanjie [6392 0337 0253]

ORG: Both of Shanghai Transportation University

TITLE: "Experimental Research on Maneuvering A Self-propelled Submersible Model"

SOURCE: Beijing HAIYANG XUEBAO [ACTA OCEANOLOGICA SINICA] in Chinese Vol 4 No 1, 15 Jan 82 pp 114-137

ABSTRACT: This paper reports an experiment of maneuvering a quarter scale self-propelled submersible model, telecontrolled by radio. The model has a displacement of one ton and is 3.8 m x 0.65 m in size. The maneuver operations, on horizontal and vertical planes and including hovering, lateral translation, turning on the spot, and mating with another object underwater, are performed in a towing tank. Special characteristics of the ducted propeller are analyzed. A drawing depicting the geometic dimensions of the model (Fig. 1) and another depicting its overall arrangement are included. The legend for Fig. 2 is as follows: (1) Vertical propeller motor; (2) 20AH silver-zinc storage battery; (3) 45AH silver-zinc storage battery; (4) Vertical tilt adjustment system; (5) Telemetric and recording instruments; (6) Telecontrol component; (7) Ballast tank; (8) Main propeller; (9) Side propeller electric motor; (10) Butt skirt; (11) Side propeller; (12) Vertical propeller; (13) Main propeller electric motor; (14) Main propeller speed reducer; (15) Rotary jacket; (16) Cabin entrance and exit cover; (17) Telecontrol antenna.

[continuation of HAIYANG XUEBAO Vol 4 No 1, 1982 pp 114-137]

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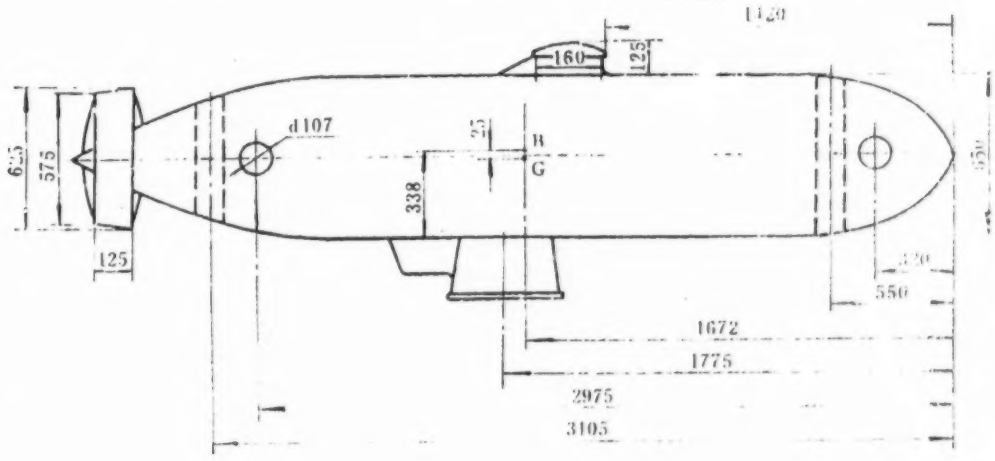

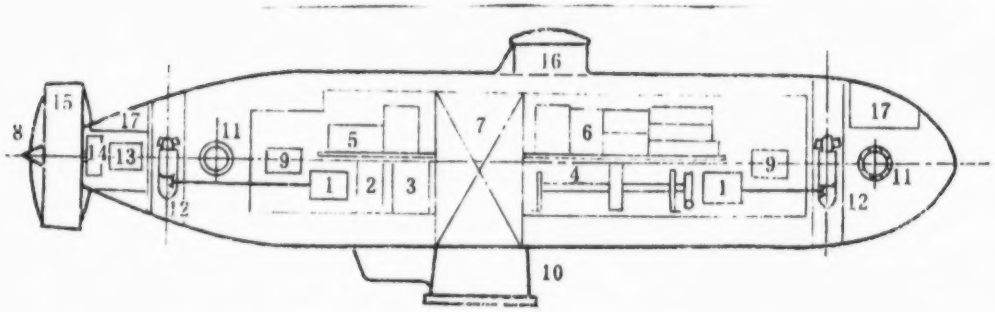

This paper was received for publication on 25 Jun 80.

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CSO: 4009/314

AUTHOR: CHEN Longzhi [7115 7127 2535]

ORG: Lanzhou Research Institute of Physics

TITLE: "Attainment and Application of Superfines"

SOURCE: Shenyang ZHENKONG [VACUUM] in Chinese No 2, 25 Apr 82 pp 42-46

ABSTRACT: At present, among Chinese vacuum technology circles the application of ultra-high vacuum to acquire superfines remains an unfamiliar subject. This paper intends to be a brief introduction of the characteristics, the method of attainment, and the range of application of superfines. Research studies on making superfines began in earnest in the 60's but it was not until 1979 when French and Japanese scientists reported independently their success in using silver superfines as a new heat exchange material for dilution refrigeration with a work temperature range of 10^{-2} - 3 x 10^{-3} K. The strange properties of metal, nonmetal, and chemical compound superfines are introduced, as well as the history of acquiring superfines from mechanical pulverizing, supersonic disintegration, low temperature comminution, vacuum freeze drying, and chemical reduction method of pulverizing, etc. The contribution of W. German scientists in improving both the condensation process and the vacuum technique and the fact that Japan leads the world in superfines technology by producing one ton a year in 1980 are mentioned.

AUTHOR: HAN Gang [7281 0474]

ORG: 71 Mirror Manufacturing Plant, Changping County, Beijing

TITLE: "New Process of Vacuum Aluminum Plating Introduced in Producing Mirrors for Civilian Use"

SOURCE: Shenyang ZHENKONG [VACUUM] in Chinese No 2, 25 Apr 82 pp 62-inside back cover

ABSTRACT: For a long time the silver plating technique has been used to make mirrors for civilian use and a large quantity of silver nitrate is used up for this purpose. The mirror industry is actually consuming nearly 50 tons of silver a year. Under the current condition of low silver production level and high cost, it has become necessary to replace silver with aluminum. The process and requirements of vacuum aluminum film plating technique of making mirrors are introduced. Due to the unstable nature of glass itself and the change of season, high temperature and humidity, etc. in the process of transportation, it is necessary to pretreat the glass before plating. There are several pretreating methods. The choice of the pretreatment method most suitable for the available plating machine and other production conditions constitutes the major production problem at present.

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REMOTE-CONTROLLED HYDROACOUSTICS DETONATOR DEVELOPED

Tianjin DIXIA GONGCHENG [UNDERGROUND ENGINEERING] in Chinese No 1, 1982 p 48

[Article by Gan Jiandeng [3927 7003 4098]: "Our Nation's First Acoustic Remote-Controlled Detonator for Insland Rivers Has Been Successfully Developed"]

[Text] Underwater demolition is the major engineering method in our nation for dredging inland river navigation channels. In this type of detonation, connecting the lead wires in deep water, in swift currents, and in bubbling eddies is very difficult and dangerous. To solve this difficulty of underwater demolition, the Ministry of Communications in 1978 assigned the First Navigational Channel Construction Department of the Changjiang Navigational Channel Bureau the scientific research task of developing an "underwater ultrasonic remote-control detonator" for carrying out underwater acoustic remote-controlled detonations. Over a period of more than 3 years, the First Navigational Channel Construction Department and the Department of Electrical Engineering of Chongqing University joined efforts and developed and assembled a prototype. It has been technically tested and used in actual test demolitions on more than 100 occasions on the Changjiang in dangerous water regions under more than 60 different conditions (different geological conditions of the riverbed and different hydrological characteristics). The tests showed that the design was rational and that it could satisfy the safe distance requirement for underwater demolition and construction. In November 1981, the higher authorities of the units involved in its development invited the experts and professors of related units--including the Chinese Acoustics Institute, universities and colleges, military construction departments, and navigational channel construction departments--to evaluate it technically. They believed that the design of this detonator was feasible. The performance of the electrical circuits was stable. The electrical properties were good. It possessed a superior ability to resist interference, and it was suitable for use under conditions of strong noise in inland rivers and severe interference from construction. It is our nation's first experimental prototype inland river and inland water acoustic remote-controlled detonator.

The techniques for assembling this detonator are still imperfect, and the units involved in its development are conducting further studies and making improvements. At the same time, they are studying and developing auxiliary detonators for underwater multiple demolition. In the near future, this new technique of acoustic remote-controlled detonation will be applied in the dredging of inland river navigational channels in our nation.

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CSO: 4008/148

SICHUAN DEVELOPS ANOTHER TWO TELECOMMUNICATIONS DEVICES

Beijing DIANXIN JISHU [TELECOMMUNICATION TECHNOLOGY] in Chinese No 2, 1982 p 48

[Article by Wei Guozhen [7614 0948 2823]: "Sichuan Provincial Post and Telecommunications Science Research Institute Again Successfully Develops Two New Devices"]

[Text] After having successfully developed the overhead exposed line ZMG 302 model high-voltage 12-channel carrier-wave facility (with a frequency band of 156-280 kilohertz), the Sichuan Provincial Post and Telecommunications Science Research Institute has developed two new devices which expand the potential of the overhead exposed line carrier-wave facility with the aim [of overcoming] the insufficient telecommunications capacity in the province and the present inability to carry out large-scale capital construction in telecommunications.

One device is the ZMC 401 type exposed line for super 24-channel carrier-wave telephone equipment (frequency band of 298 to 530 kilohertz). It adds an additional 24 carrier-wave circuits onto the pairs of lines of the newly added high-voltage 12-channel carrier-wave circuits. This means that there are 3 + 12 + higher 12 + super 24 = 51 carrier-wave circuits on one pair of overhead exposed lines.

The other device is the ZMG 303-type new high-voltage 12-channel carrier-wave equipment (frequency band, 228 to 350 kilohertz). It can be added onto four cross-indexed pairs of lines, and it supplements the ZMG 302 type device (or the ZZD-04 type device), which cannot be added to the above pairs of lines. When used jointly, the ZMG 303 device and the ZMG 302 device can add high-voltage 12-channel carrier-wave equipment onto most of the line positions of the new eight-type overhead crosslines (except for the 6th line position and the 10th line position of the new 8A type, because the degree of prevention of crosstalk is lower).

The above-mentioned two devices have already been installed on a 250-kilometer overhead exposed line with an intermediate amplifier and have been tested for more than a year. The performance has been good. The electrical quality of the telecommunications line reached the requirements of the current carrier-wave circuits. The amplification distance is the same as that of the currently used 12-channel carrier wave, and it can satisfy the distance requirements for telecommunications in the province. The original 12-channel and high-voltage 12-channel carrier-wave circuits are not affected.

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CSO: 4008/148

DEVELOPMENT OF INDUSTRIAL MICROSCOPE, GENERATOR REPORTED

Powerful Microscope

Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 2 1982 p 32

[Article by Xu Ce [1776 3261]: "[Normal] Metalloscope"]

[Text] The Chongqing Optical Instruments Plant has successfully developed the XTZ-1 model [normal] metalloscope suitable for microscopic observation and photography of metallic structures and ordinary opaque objects within the visible light spectra. It is equipped with a bright view field, a dark view field, a light polarization device, and a photographic device. It can be used by metallurgical and machinery plants, higher educational institutions, and research units for metallic detection and examination. It can also be used to examine the designs on masked pattern plates in the manufacture of integrated circuits, and to examine fine spare parts in the instruments industry.

The device has a total magnification of 100 to 1,600 times. The device has further expanded the usefulness of the metalloscope.

Direct DC Generator

[Article by Chang Jiaxiang [1603 1367 4382]: "Direct-Current Voltage Current Generator]

[Text] The Shanghai Second Electrical Instruments Plant has successfully developed the YJ 65 model direct-current voltage-current generator. The device has been technically evaluated.

The device is a type of portable precision power source suitable for use in testing industrial meters and daily maintenance of field meters and instruments. The device has four voltage ranges of 10, 100, 1,000 mV and 10V and three current flows of 1, 10, 100 mA. The output is 0-11 V standard voltage of 11mA standard current. Accuracy is $\pm$ 0.1 percent. The instrument has good ability for resisting interference, and it has an automatic protection device. When the output surpasses the allowable value, an alarm signal goes off.

9296
CSO: 4008/148

NATIONAL STANDARDS ESTABLISHED FOR CONVERSION OF ALUMINUM ALLOY

Beijing GUANGMING RIBAO in Chinese 25 Apr 82 p 1

[Article by Zhong Cheng,[5883 2052]: "Our Country Establishes National Standards for Conversion Values of Aluminum Alloy Hardness and Strength; This Is A Basic Construction in Material Science; Compared to Similar Standards in Foreign Countries, They Occupy the Leading Position in Terms of Systematization, Accuracy, and Suitability"]

[Text] After more than seven years of research work, our country has established our own standards of "Conversion Values of Aluminum Allow Hardness and Strength." These conversion values are established on the basis of our domestic material system, strength determination, and hardness standard and are based on 20 groups of conversion formulas established through nearly 80,000 experiments and data verification. They have gone through examination and approval recently and will be published for use as our national standards. Compared to similar standards in industrially advanced nations, our standards occupy the leading position and will exhibit notable economic results.

This scientific research accomplishment is the product of our great socialist cooperation. Participating in the cooperative work and in tackling the problem were principal scientific and technical personnel from eight units, including the China Metrology Research Institute, Beijing Aeronautical Materials Research Institute, No. 304 Institute of the Third Machine-Building Ministry, the Beijing Maintenance and Repair Base of the China Civil Aviation General Administration, and Northeast Light Alloy Processing Plant. The principal research personnel, Li Yuzhi [2621 3758 2535], Li Zhijuan [2621 5365 1221], Li Yushu [2621 3768 2579], Tang Rongsen [0781 2837 2773], Zong Huicai [1350 1920 2088], Yuan Huizhen [5373 1920 3791], and Guo Zhenxing [6753 2182 5281], are all middle aged engineers in their early forty's. In addition, several tens of engineering and technical personnel from 18 scientific research and production units also were responsible for some of the tasks. Their spirit of cooperation and scientific approach of dealing with facts were subjects of praises from various sectors. They were praised by experts involved in the area as having accomplished in an outstanding fashion a "basic construction project" in material science.

The National Bureau of Standards entrusted the China Metrology Research Institute to organize a national standards examination and approval meeting in Beijing during last March and early April on the "Conversion Values of Aluminum Alloy Hardness and Strength." It was pointed out during the meeting that the research plan for this work was rational. Materials selected were extensive, representative, and in common use. Sample processing was rigid and conducted with great care. The designed and selected heat treatment plan was a successful one. The testing instruments were accurate and data were reliable. Both the data processing and the establishment of conversion curves were ridig and scientific. The conversion values are accurate. They are reliable as a result of verification and have practical values. The meeting recognized that the accomplishment is a breakthrough in both scientific research and in technical application and that it is creative. It has filled a void in our basic standards. Compared with similar standards in industrially advanced countries, the established standards occupy the leading position internationally. The economic results will be extremely notable when our implementation of national stnadards has been thoroughly carried out. As an example, if these standards were adopted in a certain factory for the inspection of aluminum alloy materials and the testing of spare parts, nearly 10 million yuan would be saved annually.

What Is A Standard Conversion Value of Hardness and Strength?

The measurement of hardness is extensively used in aeronautics, aerospace, electronic, metallurgical, machinery, and chemical engineering industries. Metals, alloys, rubber, plastics and their products, soil, lumber, coal, leather, glass fibre reinforced plastic, and even fruits have their hardness indice. Hardness tests must be conducted on materials of all sizes from rails, large rollers, and aeronautical spare parts, to wrist watch spare parts and electronic parts. The use of hardness tests on various materials has the special characteristics of simplicity, speed, avoiding damages to spare parts, and diversification.

Strength is a basic property of materials. To a relatively large degree, the strength of a material determines its usefulness. The major difficulty in directly testing the various strengths of a material lies in the need to break the material or the spare part itself. Since the 1930's, people have discovered close relationships between the hardness of various standard and between hardness and strength. However, it has only been possible to carry out rough calculations. In modern industrial production, there are many spare parts which are specially large, specially small, specially thick, specially thin, or geometrically irregular. To test their strength in accordance with design requirements is extremely difficult. For this reason, they are normally tested for hardness, and the hardness is then converted to strength based on a close relationships. To use this method, it is necessary to establish a set of uniform scientific standards, namely "conversion values." In the last 10 years, many countries have been conducting research on conversion value standards between hardness and strength.

With the rapid development of the aeronautics, aerospace, and electronics industries, requirements for hardness and strength conversion values for aluminum alloys have become greater and greater. However, because of the large volumes of work, large areas affected, and the very high degree of difficulty, up to now only a few industrially advanced countries have conversion value standards for hardness and strength of aluminum alloys. Moreover, only three sets of conversion standards are available. Also, the alloy systems and technological conditions are not differentiated, resulting in relatively large errors. In the "Aluminum Alloy Hardness and Strength Conversion Value" standards established by our country, nine sets of conversion standards are listed. Moreover, conversion relationships have been established for different alloy systems and for many tens of technological conditions. The conversion accuracies are considerably greater compared to those achieved abroad. This set of "conversion values" provides a systematic numerical base for the scientific research, engineering design, and production departments in material inspection, spare parts testing, and fault analysis. It will have a direct or indirect effect in assuring product quality, saving raw materials, improving productivity, and the study of new technology. The economic results from its utilization are therefore very large.

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CSO: 4008/159

VACUUM TECHNOLOGY STANDARDIZATION COMMITTEE MEETS

Shenyang ZHENKONG [VACUUM] in Chinese No 1, 1982 inside backcover

[Article by Zhang Shufan [1728 2579 5400]: "1981 Working Conference of the National Technical Committee for Standardization of Vacuum Technology Is Held in Chengdu"]

[Text] The National Technical Committee for the Standardization of Vacuum Technology held its 1981 working conference at the Jinjiang Hostel in Chengdu from 2 to 7 December 1981. A total of 22 committee members, delegates, and secretaries attended. The liaison secretary of the National Bureau of Standards, Comrade Shi Baoquan [4258 0202 2938], also attended. Through the joint efforts of all comrades at the conference, the conference realized its predetermined goals and was a success. Delegates expressed their appreciation for the detailed arrangements and the massive work done by the 708 Plant for this conference.

The conference first reviewed a draft of the nationally standardized terminology for vacuum technology compiled by the Shenyang Vacuum Technology Institute. The draft was sent to all committee members and related units on 27 August to solicit their opinions. The shenyang Vacuum Technology Institute received comments from seven committee members. The institute conscientiously studied them and again revised the draft. The comrades attending the conference conscientiously and fully discussed the revised draft again, and unanimous opinions were expressed. The draft was written again by the drafting unit according to the GB1.1 criteria, and the participants agreed to submit the draft as the national standard for review and approval. The draft of the nationally standardized symbols in vacuum technology was also submitted with the drafts of the terms and technical terminology of vacuum technology for review and approval.

The conference then discussed the detailed articles of standardization as drawn up by the committee. The Secretariat reorganized the opinions expressed at the conference regarding the detailed articles and submitted them to the National Bureau of Standards for review and approval.

The conference discussed the summary of the work performed by the committee in 1981 and the work plans for 1982. Everybody believed that although the

committee had been established only 1 year, a lot of work had been done. In future work, conferences should not be held too often. All conferences which can be combined should be combined. Conferences must pay attention to results. Next year's working conference should have a richer content. The Secretariat must strengthen its liaison with members. Related work must be reported to the committee members in time. Finally, everyone expressed willingness to work together to elevate the level of standardization of vacuum technology in our nation.

During the conference, delegates visited the Qingcheng Paper Manufacturing Plant and the 708 Plant. The delegates learned a lot during these visits, and their conficence in carrying out the work of standardizing the terminology of vacuum technology was strengthened.

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CSO: 4008/147

REPORT OF CHINA MECHANICAL ENGINEERING SOCIETY MEETING

Beijing QIZHONG YUNSHU JIXIE [HOISTS AND CONVEYANCES] in Chinese No 1, 1982 p 44

["Academic Reporting Conference on Hoists Sponsored by the Materials Transportation Society of the China Mechanical Engineering Society"]

[Text] The Academic Reporting Conference on Hoists, jointly sponsored by the Materials Transportation Society of the China Mechnical Engineering Society and the Materials Transportation Society of the Hubei Provincial Mechanical Engineering Society, was held from 1 to 6 November 1981 in Wuchang. The head of the Hubei Provincial Bureau of Machinery Industry and president of the Hubei Provincial Mechanical Engineering Society, Bai Luo [4101 3157], attended the opening ceremony, as did Zhang Defu [1728 1795 3940], principal of the Wuhan Water Transport Engineering Academy. Prof Yang Changkui [2799 7022 7503] of the Dalian Engineering Academy and president of the National Materials Transport Society and eight directors attended the conference.

This academic reporting conference on special topics was the first nationwide professional academic conference held since the founding of the National Materials Transportation Society in October 1980. The conference exchanged a total of 50 papers. Among them, 11 were exchanged at the general conference, 13 were exchanged in group meetings, and the rest were exchanged in published form. During the conference, delegates from the Hot Rolling Plant and the Cold Rolling Plant of the Wuhan Steel Works gave a brief introduction to imported hoists, and the delegates visited the sites to learn.

The central topics of the conference were to analyze and compare the technical standards of foreign and domestic hoists, to review and summarize the achievements and problems in our design and manufacture of hoists, and to study the key problems now existing in domestically produced hoists and the ways to solve these problems. The delegates unanimously felt that at present, the key outstanding problems that exist in our nation's hoists are that the hoists' speed reducer and fundamental spare parts urgently need to be renewed and replaced, that progress in the serialization, generalization, and standardization of fundamental spare parts for the hoists is slow, that the technical performance of electrical equipment and electrical control equipment on hoists is backward, their operating life is short, and their

reliability is poor. All these things have seriously affected and hindered the improvement of the technical level of the entire hoist.

The conference hoped the delegates and the board number of technical personnel in the hoist industry would discuss and study key technical problems that exist in our nation's hoist technology, and that have been pointed out during academic exchange and discussions at the conference, in order to realize more achievements and make even greater contributions to satisfying the needs of the various professions and hasten the improvement of the standard of our nation's hoists.

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MECHANICAL ENGINEERING SOCIETY HOLDS ACADEMIC MEETING

Dalian ZUHE JICHUANG [MODULAR MACHINE TOOL] in Chinese No 3, 1982 back cover

[Draft supplied by Jie Jisheng [6043 0370 3932] and Su Boguang [5685 0130 0342]: "Mechanical Processing Society of the Chinese Mechanical Engineering Society Holds Academic Discussion Meeting"]

[Text] The 1981 academic discussion meeting of the Production System Academic Group of the Mechanical Processing Society was held in Dalian during 11-14 December. The meeting was attended by representatives and authors of papers from factory enterprises, higher institutions, scientific research units, and provincial and regional mechanical engineering societies from Beijing, Shanghai, Tianjin, Sichuan, Jiangsu, Liaoning, Jilin, Heilongjiang, Shandong, Shanxi, Hebei, Henan, Hubei and Hunan. The academic discussion meeting was chaired by directors Wang [Yong] [3769 (6978)] and Zeng Ying [2582 5391] of the Mechanical Processing Society, Chinese Mechanical Engineering Society. The focal topics of academic discussion were "technical development policy for mechanical processing" and "technical economics of high efficiency, specialization equipment." During the academic discussion, representatives expressed their own views as well as their understanding, ideas, and suggestions relative to the following problems:

1. Relationship between the promotion of automation techniques in the machine industry and the current problem of working by manual labor.

2. Current problems in the adoption and promotion of high efficiency equipment in the machine industry.

3. How to evaluate on a total and rational basis the technical economic benefits of adopting high efficiency equipment?

The 15 papers presented during academic discussion meeting were:

Zhang Shu [1728 2562]:	A Discussion on Our Country's Direction of Development of Integrated Manufacturing Systems
Chen Xunjie [7115 1789 0094]:	A Probe Into Our Country's Future Development of High Efficiency Automated Production

Pan Guishan [3382 6311 0810]:	A Probe Into Our Country's Automation Problem
Jiang Hanzhang [5592 5060 4545]:	A Probe Into Our Country's Development of Numerically Controlled Machine Tools
Hu Zhizhang [5170 3112 3864]:	A Brief Talk on the Suitability of Automated Equipment in Sewing Machine Manufacture
Li Weikun [2621 4850 2492]:	A Probe Into Problems in Machine Processing Automation Line
Zhang Jijun [1728 0679 0193]:	System of Standards and Mathematical Evaluation of Technical Economic Results of Combination Machine Tools and Their Automation Lines
Wang Lanrong [3769 5695 2837]:	Introduction to Method of Computation of Machine Utilization Time Limit
Nao Kai [6984 0418]:	Simple Evaluation of Economic Results of Equipment Investment
Shi Xiongmao [2457 7160 5399]; Yang Zhicheng [2799 5268 6134]:	Computation of Principal Technical Economic Standards of Combination Machine Tool Automation Lines
Wang Rixin [3769 2480 2450]:	Preliminary Probe Into the Service Life of Combination Machine Tools and Their Automation Lines
Wang Rixin [3769 2480 2450]:	Probe Into the Standard Investment Results Coefficient and Its Method of Computation for Combination Machine Tools and Their Automation Lines
Bai Lianzhong [4101 6647 1813]:	Price Comparison Factors Considered in the Method of Calculating the Cost of Modular Machine Tools and Their Automation Lines
Yu Yicheng [0060 6318 3819]; Chen Bingsen [7115 3521 2773]:	Analyzing the Economic Results of Making Modular Machine Tools Flexible

Based on ideas and suggestions of the representatives, the secretariat of the Production System Academic Group will improve the exchange of information of interest, organize the discussion of special academic subjects, and develop technical inquiry service and other forms of academic activities.

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EXPERIENCES IN 'UNITIZED' TRANSPORT TECHNIQUES EXCHANGED

Beijing QIZHONG YUNSHU JIXIE [HOISTS AND CONVEYANCES] in Chinese No 2, 1982 p 64

[Article by Li Shoulin [2621 1343 2651] of the Hoisting and Conveying Machinery Research Institute of the First Ministry of Machine Building: "Brief Report on the Exchange and Learning Class in Unitized Transport Techniques"]

[Text] To initiate studies in the basic knowledge of the techniques of materials flow processes and to exchange experiences in developing unitized transport techniques inside factories, an "exchange and learning class in unitized transport techniques" was held in Guangzhou from 7 to 18 October 1981 by the Hoisting and Conveying Machinery Research Institute of the First Ministry of Machine Building and the Guangdong Provincial Machinery Research Institute, with the help of the Ninth Academy of the First Ministry of Machine Building, the Food Grains Research Institute of the Ministry of Food, the Design Department of the No 2 Motor Vehicle Plant, the Xiangtan Electrical Motor Plant, the Beijing Low-Voltage Electrical Device Plant, and the Beijing First Machine Tools Plant. A total of 52 delegates from 39 factories and enterprises, design academies subordinate to the First Ministry of Machine Building, the Ministry of Food, the Ministry of Light Industry, and the Ministry of Railroads and from some provincial and municipal machinery bureaus attended the learning class. The Scientific and Technical Department of the First Ministry of Machine Building and the Guangdong Provincial Machinery Bureau also sent delegates to attend the class and to provide guidance.

The learning class conducted lectures in nine subjects: 1. Basic knowledge of material flow; 2. Basic knowledge of systems engineering; 3. Planning of materials transport systems in machinery plants; 4. Designing materials transport systems in machinery plants; 5. Warehousing; 6. Application of storage models in the production of standard motor vehicle parts; 7. Analysis of the quantity of serving trays and transport equipment needed; 8. Brief introduction to unitized transport tools; 9. Serving grays and transporting by serving trays. In addition, the No 2 Motor Vehicle Manufacturing Plant, the Xiangtan Electrical Motor Plant, the Wuxi Diesel Engine Plant, the First Academy of the Ministry of Agricultural Machinery, and the Qijiang Gear Plant also introduced their work and experiences in the development of unitized transport techniques and management at their respective units.

The delegates unanimously came to believe, because of the increased varieties of products in modern production and because of the complex productive organization, that the concept of materials transport is no longer the simple transporting of materials from locality A to locality B or the simple reduction of physical labor, but rather that it is a comprehensive problem involving production and the system of supply and marketing. It should be an organic and important part of the production system. Therefore, studying the basic theory of materials transport, and planning and designing material flow systems in factories from the viewpoint of systems engineering are the key to promoting and developing techniques for materials transport. The delegates also believed that not only is unitized transport the organizational format for solving the packaging of finished products and the transporting of spare parts within factories, but it also fundamentally changes the incidence of damage, the large-scale drop in production quality, and the serious hindrance to the development of production in the past due to collision, rust, pollution and loss of spare parts during transport. In the future, while further popularizing and perfecting unitized transport, we should also manage well the generalization and standardization of tools at work posts, serving trays, and containers, and hasten the development and production of various types of superior quality and inexpensive unitized transport machinery and tools suitable for use within shops and between shops.

Delegates to the conference placed a great deal of hope in the development of material flow techniques for the system of the First Ministry of Machine Building according to the directives of Technical Document No 360 (81) drawn up by the Hoisting and Conveying Machinery Research Institute of the First Ministry of Machine Building. It is hoped that the Hoisting and Conveying Machinery Research Institute will strengthen the leadership and organization of material flow techniques.

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INFORMATION ON DESIGN OF VIBRATING MACHINERY EXCHANGED

Beijing QIZHONG YUNSHU JIXIE [HOISTS AND CONVEYANCES] in Chinese No 2, 1982 p 64

[Article by Li Shuzhong [2621 2885 1813] of the Zhaoyang Dongfanghong Machinery Plant]

[Text] From 16 to 20 August 1981 in Zhaoyang, Liaoning, the (preparatory) design society of the China Mechanical Engineering Society held the nation's first academic meeting to exchange experiences concerning the design of vibrating machinery. Some 67 delegates from 53 units of related universities and colleges, scientific research and design agencies, and production and user departments attended the meeting. The meeting heard special reports by the Northeast Engineering Academy, the Zhaoyang Dongfanghong Machinery Plant, and the Qidashan Mineral Ore Selection Plant on scientific research, design, and use of vibrating machinery. Scientific research achievements in theoretical research and technical research, achievements in designing and testing, and achievements in major technical renovation realized during the past few years in the field of vibrating machinery in our nation were exchanged. The direction of development of vibrating machinery was explored, and 33 academic papers were exchanged.

The meeting established a technical cooperation network centered around the Hoisting and Conveying Machinery Researcch Institute of the First Ministry of Machine Building, the Northeast Engineering Academy, the Machinery Research Institute of the Luoyang Mines, the Zhaoyang Dongfanghong Machinery Plant, the Design Research Academy of the Shenyang Coal Mines, and the Qidashan Mineral Ore Selecting Plant. This has established an organizational foundation for the future development of exchanges of information and technical cooperation. The liaison office of the core group is temporarily located at the Zhaoyang Dongfanghong Machinery Plant.

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MICRODISPLACEMENT DEVICE MANUFACTURED BY XINDU PLANT

Beijing JICHUANG [MACHINE TOOL] in Chinese No 2, 1982 p 48

[Article by Tao Jiale [7118 1367 2867]: "0.05 μm Microdisplacement Device"]

[Text] The Xindu Machinery Plant followed up its development of an 0.1 μm microdisplacement device in 1980 with the successful development of a 0.05 μm-class microdisplacement device in August 1981. This type of device has a new structure, its cost is low, it is small, and its precision for repeated positioning is very high. Over a total distance of 0.05 μm intervals. It is suitable for microadjustments of various types of precision instruments and for microfeeding of super-precision machine tools.

The device was carefully examined and tested by the Chinese Weights and Measurements Scientific Research Academy in September 1981. The maximum deviation in displacement with a precision of 0.05 μm for all positions was $\pm$ 0.02 μm, and the precision of repeated positioning was 0.04 μm.

Five units of this device were developed as the first batch. At present there are several series, and they are actively being arranged for small-batch production so as to provide commercial products to relevant professions and sectors as quickly as possible.

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FORMATION OF BEIJING SCIENCE POPULARIZATION REPORTERS ASSOCIATION

Beijing YINSHUA JISHU [PRINTING TECHNIQUES] in Chinese No 2, 1982 p 13

[Article by Jin Keji [6855 0344 4764]: "Formation of Beijing Science Popularization Reporters Association"]

[Text] The Beijing Science Popularization Reporters and Editors Association was formed in Beijing on 13 January 1982. This is a mass organization of an academic nature of reporters and editors engaged in publicizing science popularization from the publicity departments of newspapers, journals, broadcasting [organizations], and television. It is an academic organization under the Beijing Municipality Science Association. It is also the first of the local organizations to be formed under the China Science Popularization Reporters and Editors Association.

The planning for the formation of the Beijing Science Popularization Reporters and Editors Association was started last August at the time the national association was formed. The Beijing area has nearly 90 newspapers, journals, broadcasting [organizations], and television stations which are engaged in publicizing science popularization, ranking first in the country in terms of techniques, extensiveness of content, and audience. The formation of the Beijing Science Popularization Reporters and Editors Association has an important significance in uniting the large numbers of science popularization reporters and editors in the Beijing area to develop academic exchange, study work patterns, improve quality of publicity, and better serve the four modernizations.

As a result of full deliberations and democratic consultations prior to the meeting, He Xing [0149 1630] and 35 others were recommended to serve as directors on the First Board of Directors of the Beijing Science Popularization Reporters and Editors Association. Party Unit Secretary Comrade Tian Fu [3944 1133] of the Beijing Municipality Science Association came to the meeting to give a talk. Leading comrades of publicity departments for news and publications also attended the meeting.

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APPLIED SCIENCES

SCIENCE AND TECHNOLOGY ACHIEVEMENTS REPORTED

Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 1, 1982 p 106

[Draft material supplied by Xiao Yuchang [5135 3768 2490]: "Science and Technology Achievements"]

[Text] Model Δφ250/φ310 Reaming Tool for Mine Use

This is a modern large drill tool, successfully developed and manufactured jointly by our institute, the Shanghai No 1 Gasoline Engine Plant, and the Dagushan Iron Mine in Anshan. It has the advantages of simple construction, large self-advancing force, energy saving and drilling of large holes with small axle pressure. Through trials in industrial production, it has shown that, compared with the φ310 drill bit used originally and when drilling in f = 16~18 rocks, the drilling efficiency is improved by 22.08 percent, cost is reduced by 53.27 percent, the amplitude of drill vibration is reduced by two-thirds, the accident rate of the drill is lowered, and the life of the drill bit is increased by 177.22 percent. Based on the overall condition of using the 60-RIII drill and φ250 drill bit at the Dagushan Iron Mine, changing to the use of the φ250/φ310 reaming tool for hole drilling means the saving of 98,000 yuan in drill tool expenses annually for each drill used.

Model ΔSFS-300 Pneumatic Rock Breaker

Aimed at the problem of secondary breaking of large rocks which are common in metal and nonmetal mines, our institute cooperated with involved mines and plants of the Beijing Iron Mine and the Beitai Iron Mine and successfully manufactured the "Model SFS-300 pneumatic rock breaker." It replaces the traditional and outdated breaking methods of manual hammering, secondary blasting with explosives, or secondary drilling and blasting. It greatly reduces the labor intensity of the workers and achieves safety in production at the mines. This type of rock breaker has the advantages of structural reliability, good stability, high adaptability, large crushing power and high productivity. The economic results of this equipment are notable. Because of the savings in blasting materials, chutes and screens, the Beijing Iron Mine reduced its expenditures by over 100,000 yuan each year for each breaker used. With a slight modification of accessory equipment, this machine can also be used for breaking up old reinforced concrete roads, cleaning furnace linings in metallurgical enterprises, and breaking piles in the construction enterprises.

del G-01 Distillation Nitrogen Fixation Instrument

ned at overcoming the disadvantages of large distillate volume, lengthy time of termination and low determination sensitivity of the [Kelly] nitrogen fixation stillation installation which is widely used both here and abroad, our institute successfully developed and built the "Model G-01 distillation nitrogen fixation strument." It employs the unique methods of direct heating and reduced pressure stillation as well as neutralization and titration during distillation. The vantages of small distillate volume, rapid determination, wide range [of application], good repetitive results and high accuracy have been achieved. The entire stallation is logically designed. compact, easy to operate, easy to control and low in cost of construction. It is suitable for the determination of nitrogen ntent in iron and steel, nonferrous metals, alloys, pure metals, slag, chemical rtilizers, soil and other products.

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O: 4008/150

TECHNICAL EVALUATION MEETING ON QY8 CRANE TRUCK CALLED IN WUHAN

Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 3, 1982 p 48

[Draft material supplied by Li Weimin [2621 0251 3046]: "Technical Evaluation Meeting on QY8 Crane Truck Called in Wuhan"]

[Text] A technical evaluation meeting on the QY8 crane truck, jointly designed and trial manufactured by the Hubei Construction Machinery and Equipment Plant and the Construction Machinery and Equipment Research Institute of the State Capital Construction Commission [Guojia Jianwei], was held in Wuhan Municipality, Hubei Province, from 24 December to 26 December 1981.

Participating in the meeting were 50 representatives from 31 units all over the country, including universities and special institutes, research departments, manufacturing plants concerned, and user departments. The meeting was jointly chaired by the Bureau of Construction Machinery and Equipment of the State Capital Construction Commission and the Construction Commission of Hubei Province.

The QY8 crane truck is a totally turn-around, adjustable arm, hydraulic crane mounted on an EQ140 truck base. It is suitable for such work as industrial and civilian construction, cargo loading and unloading, and equipment installation.

During the meeting, reports on the design, manufacture, trial, industrial evaluation and consumer use of the QY8 crane truck were heard. Technical materials were studied and the operation of a prototype machine was viewed. It was agreed by all the representatives that the equipment has superior technical properties, the design parameters were logical, the model has a pleasing appearance, and that in the domestic design of crane trucks the use for the first time of the new techniques of dual speed hoisting and guide valve control was a successful one. The prototype machine had been through complete testing and operated through 5,350 operational cycles in five types of working conditions. The machine was then taken apart for inspection and found to meet good quality standards and design requirements. It had received a good evaluation by consumers because of its easy operation, high productivity, and easy maintenance and repairs. In summary, the trial manufacture of the machine was a successful one, meeting the advanced standards in China. The meeting recommended that a small quantity of the machines be produced.

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MACHINE TOOL INDUSTRY CAN SERVE SEWING MACHINE INDUSTRY

Dalian ZUHE JICHUANG [MODUIAR MACHINE TOOLS] in Chinese No 4, 25 Apr 82 inside front cover

[Article by Gao Baoliang [7559 0202 5328]]

[Text] The development of a sewing machine industry in China is an implementation of the national economic readjustment policy of recent years. For this development, there is certainly a great deal to be done by the machine tool industry. In the past 3 years, more than 200 special tools were designed for the sewing machine industry by the Dalian Research Institute of Modular Machine Tools alone.

The large scale development of the sewing machine industry began in 1980. It was launched with a great force. The 63 designated sewing machine plants of the country almost all demanded new equipment or refurbishment. Just for making the casing, the base plate, and finishing after painting, if each plant is to be provided with one set of tools, 3087 machine tools will be needed. At an estimate of 30 thousand yuan each, the total may reach 92.61 million yuan. This is a very considerable figure. Since 1980, all the sewing machine plants have ordered a large number of tools from the machine tool plants of the Ministry of Light Industry (such as Nanjing Light Industry Machinery Plant, the Shenyang Light Industry Machinery Plant, and Taian Light Industry Machinery Plant) and the various plants of the Bureau of Machine Tools, but they have not ordered a sufficient number of them. This is especially true with the after-painting finishing tools (about 16 tools in a set.) These tools were ordered by several plants only. The remaining large number of plants are still waiting.

Furthermore, a sewing machine contains 147 parts, of which 75 parts need special tools to process. If each of these requires 4 special tools, a total of 300 machine tools are needed. At an estimate of 10 thousand yuan per tool, each sewing machine plant will need 3 million yuan. For the 30 parts-plants of the country, the total may reach 90 million yuan. It appears that the sewing machine industry is a good market for the machine tool industry. The question is how are we going to take over this market.

What are the current problems in our machine tool industry? The first problem is the fact that many machine tool plants do not recognize this market. The second problem is the fact that many plants do not know how to take advantage of this situation. The third problem is the fact that the level of management of our plants

is too poor to satisfy the requirements of the sewing machine industry. The fourth problem is the fact that the price of the tools we supply is too high, the delivery time is too long, etc. So, what should we do?

(1) We should assume an attitude of servicing the light industry markets. The light industry markets must not be looked upon as a matter of expediency with no long term considerations. This is a problem the current leaders of all levels should give their proper attention.

(2) The various plants should seriously organize technicians to design special equipment and encourage them to be positive about it. What should be done if all these plants say they have no sufficient capacity for this job? Attention should be seriously given to the educated ones to cause them to be fully functional. The work of designing should be regarded as the first work process in the production procedure.

(3) The scientific research departments of these plants should start the work of studying and designing products. They must not set scientific research and designing work aside and ignore it. All the plants should be producing the first generation products while thinking about the second, the third generation products. This is the only way to bring business to one's own plant and to make it prosperous.

(4) All the plants should strengthen market surveys and technological researches. They should behave like good counselors and advisers of the users in matters of equipment selection. For example, when special tools are used to make certain key parts, the quality of these parts will improve and moreover the equipment capacity of the entire plant may thus be more fully utilized to bring about overall improvement to its productivity. This kind of additional economic benefit is especially very apparent when some old factories adopt technical reform.

(5) The plants should strengthen plant management, reduce the cost of production, shorten the production cycle, etc. They should study methods of scientific management and designs of work procedures to find ways of reducing cost and production time so as to shorten the production cycle.

(6) The quality of products should be strictly controlled. Reputation is the life of the factory. There should be a guarantee that only qualified products may be allowed to leave the plant. There should be precise and practicable indices of reliability for all types of special tools in the catalogue.

(7) The order and delivery contracts should be faithfully carried out and after-sale services should be satisfactorily provided. This is also a problem demanding our attention. At present, some plants want jobs so eagerly that they sign contracts with many users but cannot deliver the goods on time. They delay, delay, and delay to cause very bad reactions from the users. This sort of thing will affect our reputation. After machine tools are delivered to the users, we should also enthusiastically help them adjust and test these tools.

With the development of the national economy, all industries are trying to improve the quality of their products and expand the number of products they produce. This is true with the sewing machine industry also. We should provide good service as our users grow and prosper. This is the only way to keep our industry vital and successful for ever.

6248
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ERRATUM: This article is republished from JPRS 80949, of 1 June 1982, No 163 of this series pp 6-12 to correct certain terminology.

APPLIED SCIENCES

ERRATUM: CHINESE EVALUATE SA 365N DAUPHIN 2 HELICOPER

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 4, Apr 82 pp 5-7

[Article by staff reporters of 'INTERNATIONAL AVIATION']

[Text] On 6 February 1982, the sky was clear, but the air around the capital's airport was filled with early spring chill. Rows of passenger cars carrying over a thousand spectators from all over the country were heading toward one of the flight test fields in the airport. They all came here to witness the first exhibition flight of the first SA 365N Dauphin 2 helicopter (No 6013) produced in this country.

At 9:30 sharp, accompanied by the roaring sound of the engine, a white and blue Dauphin 6013 was lifted from the ground. At a height of approximately 5 m, the helicopter made a sharp 90° turn to the right and began to climb upward with great speed. In a short while, it began demonstrating a number of maneuvers: diving and dashing at the review stand; climbing vertically and then hovering at an altitude of 400 to 500 m; making a 90° right turn followed by a left turn, and suddenly "dropping" straight down; then gradually climbing backward again as the spectators applaud with admiration. During the 15-minute performance, over 20 maneuvers were executed one after another; they fully demonstrated the superior mobility of the Dauphin helicopter.

As soon as the flight exhibit ended, the spectators rushed toward the helicopter to congratulate the Chinese and French pilots who took part in this exhibit. We took this opportunity to arrange an interview with the planning director of the Technology Advancement Department of the Chinese Aeronautical Technology Import-Export Company (CATC), asking him about the joint Sino-French effort in producing the Dauphin helicopter. We also located the chief engineer of the Harbin Airplane Factory to ask him about the main features of the Dauphin 2 helicopter. Finally, we interviewed the co-pilot of this demonstration flight, and talked about his experience in operating the Dauphin. The contents of these interviews are summarized below.

Sino-French Joint Venture

The SA 365N Dauphin 2 helicopter is a medium-size general purpose helicopter developed by the French Aerospatiale Company. It was evolved from the 365C model and was issued a French Aviation Certificate in 1981. It is a technologically advanced product of the late 1970's. Recently, China adopted the French manufacturing techniques and began production of the helicopter as well as the engine. Prior to reaching a decision to select this model, the CATC

had made a detailed analysis and comparison of the more advanced helicopters from various countries and had visited many companies abroad.

In July 1980, the CATC signed a technology transfer contract with the French Aerospatiale Company, which was later approved by both governments in October of that year. The contents of the contract were as follows: 1) France will transfer the complete set of technical procedures for manufacturing the helicopter and the engine to China; 2) France will initially deliver two completed helicopters to China; subsequently, it will deliver certain parts to be assembled in China; in time China will manufacture all the parts and assemble the entire helicopter. The Dauphin 6013 which took part in the demonstration was the first of the two helicopters which were flight-tested and certified in France and delivered to China on 29 January of this year. The contract also stipulated that as compensation China will return a certain quantity of manufactured helicopter parts to France. With this type of joint venture agreement not only can we learn the most advanced helicopter technologies and acquire the products with minimum time delay, but also save considerable foreign exchange by not directly purchasing the product from abroad.

Main Features of the Helicopter

The SA 365N Dauphin 2 helicopter is considered a fairly advanced product among helicopters of a similar class. It is light-weight, and has high speed capability; its moving parts are reliable and have relatively long design lives; it is also easy to maintain and operate. Its design was based on the following guidelines: large passenger cabin easy entrance and exit; high cruising speed and large effective payload; long range with good economy; high degree of maneuverability and mobility; long operating life between repairs and ease of maintenance. In the development and production of this helicopter, many advanced technologies were incorporated. The main features of this helicopter include the following.

Composite Material Rotor: The rotor consists of 4 blades made of fiberglass and graphite. The rotor type is OA2 212-207; it has a twist of 10°, a blade-tip sweep of 45°; its turning efficiency is 0.75, and its nominal speed is 348 rpm. This type of composite material is strong and easy to machine; it was used on another helicopter Gazelle made by the French Aerospatiale Company. It has been reported that during an accident where two helicopters collided, the rotary blades of the Gazelle chopped the other helicopter into two halves; the body of the Gazelle was destroyed, but the rotary blades were essentially undamaged. Furthermore, metallic blades have poor corrision resistance; they must be constantly inspected using microscopes to search for corrosion spots caused by sea water or chemical gas; if not discovered in time the corrosion spots may develop into cracks and cause the blades to fracture. Blades made of composite materials do not have this problem, which is a desirable property when operating over ocean surfaces.

The leading edge of each blade is covered with a stainless steel belt for protection against damage by debris. The four blades can also be folded backward to save parking space. The time required to fold the blades is approximately 10 minutes; for subsequent operation the blades can be directly unfolded without further adjustment. If one of the four blades is damaged, each can be replaced individually; the replacement blade can also be used without adjustment.

Star-shaped Flexible Blade Housing: This is one of the new composite material blade housings developed by France in the late 1970's. It has a star-shaped plate structure made of fiberglass and epoxide material. The plate arms have high damping rigidity and flexibility required for swinging motion; they also have visco-elastic damping devices.

The main advantages of this type of blade housing are that it does not require lubrication or maintenance, and it is highly reliable. For example, if a metallic blade housing develops a crack, it is likely to be destroyed under the action of centrifugal forces, and break into pieces. The composite material blade housing, on the other hand, will automatically stop operation under these conditions; furthermore, the cracked component will change color, making it easy to identify and replace. The composite material blade housing also has a simple structure, with only 64 parts, which is 4/5 less than the metallic blade housing of the Alouette; its weight is only 57 kg, which is 55 percent that of the Alouette. The Dauphin helicopter suffers little vibration during flight; this is partly due to the vibration-suppressing counterbalance weight in the rotary blade, and partly due to the special design of the blade housing. The reduced vibration level results in extending the useful life of each component of the helicopter, and the airborne instruments and equipment.

Culverted Tail Rotor and Nonsymmetrical Vertical Tail: The tail rotor is located within the vertical tail. It has 13 rotor blades; its diameter is 0.9 m, and its speed is 4,700 rpm. The life span of the tail rotor blades is essentially infinite, and there is no lubricated axle. This type of tail rotor is safer than the conventional type in that it will injure ground personnel, and the pilot need not worry about it hitting objects on the ground or tree tops when operating at low altitudes.

The vertical tail of the Dauphin has a relatively large area and uses a nonsymmetrical wing design, so that it can produce a certain amount of countertorque. Even when the tail rotor fails, this design will enable the helicopter to return to the airport at cruising speed, and perform a glide landing at a speed of 75 km/hr. This countertorque also allows the helicopter to cruise at high speed with almost no power loss due to the tail rotor. Therefore, the fuel consumption of the Dauphin is less than helicopters with conventional tail rotors, and its range is correspondingly increased.

Propulsion System: This helicopter has two Arriel 1C turboengines developed by the Turbomeca Company during the 1970's. The peak power of each engine is 710 hp; the power to weight ratio can be as high as 6, and the fuel consumption is only 250 g/hp-hr. The engines are equipped with an automatic power equalizing device, so that when one of the engines fails, the other will automatically increase its power to an emergency level. Therefore, the Dauphin helicopter can perform a type-A take-off under full load conditions; conventional helicopters under similar conditions must reduce payload (passengers or fuel) to meet aviation regulations. The single-engine climb rate can be as high as 1.7 m/sec. In addition, the engine also has a fast-response advancing device connected to the blade pitch, which allows the power to increase from minimum to maximum in only 2 seconds.

The engine structure is of a molded design, which only has 5 unit components. To disassemble the engine into individual units only takes 8 minutes; to

assemble the engine requires 24 minutes. When the engine is malfunctioning, it is only necessary to replace the unit which is defective.

Composite Material Body Structure: The body structure contains 59 percent composite material, 28 percent aluminum-Nomex sandwich structure, and 13 percent conventional riveted aluminum structure. This type of structure not only results in a reduction in weight, but also in the manufacturing cost and aerodynamic drag. As a result of a series of weight reduction measures, the maximum ratio of take-off weight to empty weight can reach 1.95. Therefore, even though the exterior of this helicopter does not differ a great deal from that of other light-weight helicopters such as Alouette 3 or the Bell-212, its cabin capacity (5 m^3 plus luggage compartment) is larger, and its load capacity is comparable to that of the U.S. S-76.

Safety Features: The Dauphin helicopter has redundant hydraulic, fuel supply, and electric systems, some of which even have three-unit redundancy. The dimensions of all mechanical components have relatively large tolerances so that in case of a failure in the lubrication system, the helicopter can continue to fly for 30 minutes, during which time the pilot can call for help or attempt an emergency landing. Other emergency measures include an emergency fuel dumping system which can release all the fuel in a few seconds, and emergency pontoons in case of forced landing over the ocean. The emergency pontoons are normally stored inside the body so it does not affect the flight speed; if the helicopter is forced to land over the ocean, the pontoons are automatically inflated within a few seconds (see title figure); at the same time two life rafts each having a 10-person capacity automatically slide down from top of the cabin and after inflation stand ready at two sides of the helicopter. The fuel tank and the tail section of the helicopter are both sealed structures with good buoyancy characteristics. On conventional helicopters, the rotor cannot be started in a high wind exceeding 75 km/hr; otherwise the helicopter may topple over. The Dauphin 2 on the other hand is equipped with star-shaped blade housing and stopping blocks on the blades, so that it can be started safely even in a strong wind with 100 km/hr wind velocity. Therefore, the Dauphin 2 can operate in a strong wind with intensity 7 over the ocean.

Maintainability: The Dauphin 2 helicopter generally requires a minor repair every 300 hours and a major repair every 2,400 hours; the maintenance time for each flight hour is 0.47 hours, whereas some helicopters require as many as 11 hours. The procedures for disassembling and assembling mechanical parts are quite simple. By using the special tools in the luggage compartment and a small crane, a technician and the pilot can remove the four blades in 10 minutes (8 minutes for installation), disassemble the blade housing and the main speed-reduction unit in 1 hour 50 minutes (1 hour 13 minutes for installation), and remove the engine in 1 hour 30 minutes (1 hour for installation). The helicopter also has good accessibility. In addition to the two doors to the cockpit, there are four doors to the passenger cabin. On each side of the helicopter is a retractable stepping board; there is also a door to the luggage compartment. The main speed-reduction unit has many inspection windows through which the operating conditions can be monitored. The units which require frequent maintenance all have hinged covers; the entire nose section is also a hinged cover which in its open position will clearly reveal all the circuitry of the onboard equipment and instruments for easy maintenance (see back cover). Therefore, since the delivery of the SA 365N last year and its

predecessor SA 365C in 1978, there have never been any accidents during operation.

Performance and Applications

The helicopter's main performance parameters are listed as follows:

maximum gross weight	3,850 kg
effective payload	1,810 kg
maximum external load	1,700 kg
maximum continuous power	594x2 hp
maximum speed	306 km/hr
cruising speed	260 km/hr
maximum range	882 km
maximum climb rate	7.7 m/sec
dynamic ceiling	4,000 m
hover ceiling	2,350 m (with ground effect)
	1,200 m (without ground effect)
fuel consumption per km	1.06 kg

Compared with other helicopters of its class, the outstanding features of the Dauphin 2 are: larger payload, longer range, higher speed, and better economy. For example, the maximum range of the Bell-212 is 47 percent less, that of the Bell-412 is 28 percent less; the fuel consumption of the Bell helicopter is 1.5 kg/km whereas that of the Dauphin 2 is only 1.07 kg/km. Therefore, the higher initial cost of the Dauphin 2 is more than compensated by its long-term economy and its reliability. However, it must be pointed out that the SA365N helicopters currently being produced in France do not all meet the performance specifications stated in the Sino-French contract. The French Aerospatiale Company is currently taking measures to correct this situation.

The Dauphin 2 has many applications. There are about 50 selected services suggested by the French Aerospatiale Company. The basic model can be easily modified to perform special missions such as off-shore petroleum operations, transportation of personnel, off-shore support activities, rescue operations, elevated construction work, installation of high-voltage lines, aerial photography, geological exploration, oceanic patrol, and forest fire prevention. The U.S. Coast Guard recently ordered 90 Dauphin 2's for its short-range retrieval operations; Canada and Saudi Arabia also purchased the Dauphin 2 for their petroleum exploration activities. The French Aerospatiale Company has also developed military versions of the helicopter such as the SA 365F Dauphin 2.

Operating Characteristics

The co-pilot who participated in this flight demonstration, Comrade Ye Guanwei [5509 6034 4850], had spent more than 3 months in France for flight training. Except for a few very special subjects, he had mastered most of the training courses. He considered the Dauphin 2 an outstanding helicopter: light-weight, good aerodynamic design, retractable landing gears, and high speed--during a dive the maximum speed can reach 324 km/hr, which is quite unusual for helicopters of this class. Furthermore, the maximum range can reach 350 km; but if the fuel tanks are loaded to full capacity, then only 6 passengers can be accommodated (normal capacity 10-14 passengers). Comrade

Ye Guanwei was most impressed by the manueverability of the helicopter. Compared with other helicopters he had flown, he considered the control system of the Dauphin 2 to be more complicated, but once familiar with the system, it becomes very easy to maneuver the helicopter. During this flight demonstration, the high degree of mobility allowed a number of difficult maneuvers to be executed with little control. However, high mobility implies poor stability; thus when the helicopter encounters a disturbance such as a wind gust, it tends to sway more than others. Comrade Ye did not notice any difference in the control characteristics between a culverted tail rotor and conventional tail rotors, but the improved safety of the culverted tail rotor gives the pilot psychological peace of mind.

3012
CSO: 4008/158

BRIEFS

INTERNAL COMBUSTION LOCOMOTIVES--The double innovation [shuang ge] technical information network of the Ministry of Railway's Locomotive and Rolling Stock Industry System has decided to call an all-railway "technical experience exchange meeting on energy conservation of internal combustion locomotives" in the latter part of May 1982. Currently, to welcome the meeting, energy conservation experiences on internal combustion locomotives are being conscientiously summarized and preparations for actively writing papers, reports, and other materials are being made by engineering and technical personnel of internal combustion locomotive manufacturing and repair plants, railway bureaus and maintenance sections and their related scientific research units, and higher institutes and universities. [Text] [Dalian NEIRANJI [INTERNAL COMBUSTION ENGINE] in Chinese No 2, 1982 p 51] 5974

NEW FIBER OPTIC--Shanghai, 7 Jun (XINHUA)--Scientists in Shanghai have successfully developed a new kind of fiber optic called a "monomode." The fiber, 1/10 of thickness of a human hair, is used to transmit various kinds of information with the help of a laser, and can simultaneously carry over 1 million-channel telephone circuits. Its advantages include greater information carrying capacity and longer transmission distance, compared with the multimode fiber which China developed several years ago. The fiber can also be used to make fiber optic gyros and sensors. The monomode fiber was developed by the scientific workers at Shanghai University of Science and Technology and the Shanghai Quartz Glass Factory after 2 years' efforts. Professor Huang Hongjia, vice president of the university, who contributed to the fiber research, said that the application of monomode fiber opens a broad horizon for modernizing the country's telecommunications, and also places China in the front rank in world light technology research. [Text] [OW101355 Beijing XINHUA in English 0731 GMT 7 Jun 82 OW]

CSO: 4010/7

LIFE SCIENCE

SCIENTISTS CLONE HEPATITIS B VIRUS STRAIN

OW141258 Beijing XINHUA in English 1243 GMT 14 Jun 82

[Text] Beijing, 14 Jun (XINHUA)--Scientists at the Shanghai Institute of Biochemistry have for the first time successfully cloned a particular straing of hepatitis B virus, according to the division of biological sciences of the Chinese Academy of Sciences.

The success in manufacturing ADR hepatitis B virus (HBV) Genome marks a major step in China's genetic engineering research, academy sources said today.

Hepatitis B, caused by HBV infection, is one of the more serious diseases in the world today. It is estimated that about 200 million people are infected and scientists believe that HBV may have something to do with the onset of cirrhosis and liver cancer, since it frequently leaves the vital organ weakened or damaged.

There are four types of the virus: ADR, ADW, AYR and AYW. The genome cloning of ADW and AYW HBV has been accomplished in the United States, France, Britain and the Federal Republic of Germany. However, the genome cloning of ADR HBV, prevalent mainly in China, Japan and some Southeast Asian countries, has so far not been reported.

The scientists at the Shanghai Institute of Biochemistry began their genetic engineering research on NBV in 1980. Last year, scientists of the institute's molecular genetic laboratory and tumor research group isolated and purified the ADR HBV genome from the plasma of Chinese HBV carriers. Early this year, they, in cooperation of the Shanghai municipal epidemic prevention station, completed the genome cloning of the ADR HBV in Escherichia (E) Coli. The transformation efficiency was high and a maximum of 158 clones of ADR HBV genome were obtained in the experiment.

The success demonstrates that China's genetic engineering research on HBV has advanced to world rank. It also has provided favorable possibilities for China to independently produce hepatitis B vaccine through genetic engineering and further study of ADR gene structure, DNA sequencing and gene expression.

CSO: 4008/184

BRIEFS

CHILDREN'S MEDICINES IN SHORT SUPPLY--(Feng Fuchun), a worker at the Shenyang Railway Bureau wrote a letter to our station urging that medical departments guarantee the supply of children's medicine. The letter states: In the past few years, the state has shown great concern for protecting children's health. However, some hospitals and clinics, ignoring the fact that they have pediatrics departments, seldom stock children's medicine. Doctors prescribe penicillin to all children no matter what kind of diseases they have, or erythromycin to those who are found allergic to penicillin. Some children suffer from abdominal pains and diarrhea after taking erythromycin. Each family is allowed to have only one child under the family plan. When children are sick, their parents worry. If hospitals do not have medicine, the parents will worry even more. Sometimes, they have to get medicine at a pharmacy on their own. This not only affects the timely treatment of the ill children but also causes troubles for parents, who sometimes will make mistakes in haste. Some children's daily medicines which are in full supply and are cheap cannot be found in hospitals and clinics for a long time. Children's tranquillizers and medicines to relive indigestion, coughs and asthma cannot be seen at all. I hope medical departments care for children and solve the children's medicine problem as soon as possible. [Text] [SK291234 Shenyang Liaoning Provincial Service in Mandarin 2200 GMT 28 May 82]

PROGRESS IN TREATING CANCER--Beijing, 2 Jun (XINHUA)--China has achieved initial success in using home-made hemato prophyrin derivative (HPD) and lasers to diagnose cancer, according to Cong Zhong, an official of the Chinese State Scientific and Technological Commission. HPD is a component of hemoglobin with a specific affinity for cancer cells. When injected, it stores mainly in diseased cells. When irradiated by lasers of a certain wave length, it glimmers orange, thus locating cancer and enabling its earlier discovery, Cong Zhong said. When irradiated by lasers of another wave length, the HPD reacts photochemically, oxidizing and destroying the affected cells. It leaves healthy cells largely undamaged, Cong Zhong said. Research began on HPD in May 1980. In the past 2 years, he said, the photo-sensitization therapy has been used to diagnose and treat oral leukoderma, skin cancer, muscosa carcinoma and other kinds of cancer. Cong Zhong said more theoretical and practical work will be done to expand the application of the therapy and improve the diagnosis and treatment of cancer. [Text] [OW020728 Beijing XINHUA in English 0718 GMT 2 Jun 82]

CSO: 4008/180

INTRODUCTION TO NATIONAL DEFENSE SCIENCE, TECHNOLOGY UNIVERSITY

Beijing HANGTIAN [SPACEFLIGHT] in Chinese No 2, 26 Mar 1982 pp 6-7, 32 and inside back cover

[Article by the Admissions Office, National Defense Science and Technology University]

[Text] The National Defense Science and Technology University, previously known as the Harbin Military Engineering College, was built in 1952, and began operation in 1953. Chairman Mao had delivered a speech at the College, and had personally named the school publication "Gong Xue." In addition, a number of proletarian revolutionists including Zhou Enlai, Zhu De, Deng Xiaoping, Chen Yi, He Ling, Liu Bocheng, Ye Jianyin, had also visited the College and provided guidance to the school.

In 1970, the school moved south to Changsha City and was renamed the Changsha Engineering College; in 1978, it was re-established as the National Defense Science and Technology University. The mission of the school is to produce highly qualified scientists and engineers devoted to research, design, production, experimentation, and application in high technology fields related to national defense. Currently, there are eight departments: Applied Mechanics, Applied Physics, Automatic Control, Electronics, Materials and Fuels, Electronic Computer, System Engineering and Mathematics, Precision Machinery, plus the Department of Advanced Training for Government Officials. The school has 23 specializations, 39 lecture and research offices, 5 central research laboratories, and many special laboratories; it has a well-equipped electronic education center, and a modern computer center for teaching and research. The school library (a new library building with modern facilities has been completed) has total volumes of over 600,000, and over 2,000 Chinese and foreign periodicals. In order to strengthen political awareness and encourage academic interchanges, the school has two publications: the "National Defense Science and Technology University," and the "National Defense Science and Technology University Bulletin." The College also has a fully equipped experimental factory, a modern computer plant, and a print shop. In addition, there is a hospital which serves both faculty members and students.

The school is administered by committees whose members are experienced Party leaders, professors, and scholars. Currently, there are approximately 1,500 teachers and professionals; more than 210 of them have ranks higher than assistant professor.

During the 29 years of the school's history, over 16,000 students have been graduated. It has made significant contributions in building China's military engineering teams, particularly in the area of high technologies related to national defense.

While teaching is the main objective of the school, it has also been actively engaged in scientific research. Since its establishment, the school has undertaken over 700 research projects for the engineering departments of various military services. Many of these projects are considered to be of critical importance to China's engineering development; 19 projects won awards at the 1978 National Science Convention, and 58 projects won awards at the Hunan Provincial Science Convention. At present, the school has over 100 projects devoted to special engineering problems and other scientific missions for Government agencies and the National Defense Science Committee.

The academic curriculum of the National Defense Science and Technology University is described below.

The curriculum of the Applied Mechanics Department covers primarily the application of basic theories and experimental techniques of mechanics to aerospace activities, as well as the solution mechanics problems encountered in aerospace applications. The Department offers the following specializations: fluid dynamics, aircraft solid mechanics, and rocket engines; it also has a central research laboratory and several special laboratories. The contents of fluid dynamics include the laws of motion of a spacecraft in the atmosphere, high-speed convective heat transfer, separated flow, computational fluid mechanics and experimental techniques, and magneto-hydrodynamics; it provides the student with a sound theoretical background for designing spacecraft, and particularly for solving the re-entry problem. The contents of aircraft solid mechanics include fracture control of spacecraft structures, finite element method for structural analysis, vibrations, structural mechanics of composite materials, structural optimal design, and mechanical properties of aerospace materials. The contents of rocket engines include variable-thrust liquid rocket engines, system analysis of liquid rocket engines, theory of combustion of rocket engines, and basic theory and experimental techniques of heat transfer and mass transfer, as well as the internal operation of solid rocket engines. It provides the necessary theoretical background and experimental data for rocket engine design. This Department produces research scientists and engineers who have solid theoretical foundations and familiarity with the basic principles of engineering design; they are also proficient in modern experimental techniques and electronic computer usage, and are qualified for the tasks of designing and building spacecraft and modern strategic weapons.

The curriculum of the Applied Physics Department covers primarily the application of new results in modern physics to the problems of national defense; in particular, emphasis is placed on the investigation of interaction between matter and particles such as photons, electrons, and neutrons. This Department offers the following specializations: radiological physics and protective measures, laser technology, explosion physics, and infrared remote sensing techniques, it also has a special training class for physics instructors.

Laser technology is one of the newly established specializations in this school. Because of laser's unique characteristics, its applications in national defense have grown rapidly in recent years; they include laser guidance, laser ranging, laser communication, and laser thermo-nuclear fusion, which is under current development. The laser specialization in this Department is designed to train advanced scientists and engineers who will devote their careers to research, design, and experimentation related to the application of laser in national defense. At present, it is responsible for many important research projects in which significant contributions have been made. For the benefit of both graduate and undergraduate students, the Department has well-equipped experimental facilities and a highly qualified faculty. Radiological physics and protection is an older specialization in this Department. It is designed to train theoretical research scientists and engineers who will devote their careers to radiation detection techniques (e.g., α-ray, X-ray, neutron radiation, and electromagnetic pulse, etc.) and the study of interaction between radioactive particles and matter and protective measures against radiation. Explosion physics is a specialization which was established in 1961 by merging two independent specializations: explosion mechanics and high energy physics. It plays an important role in high technology national defense and is devoted to the study of the physical and mechanical properties of matter under special conditions such as high temperature, high pressure, rapid deformation, and plasma; in other words, it is concerned with the dynamic response and dynamic destruction mechanisms of matter under these conditions. It is a specialization which encompasses both physics and engineering mechanics. The physics instructor training class was established to train faculty members for military technical institutes. In order to provide the students with modern techniques in experimental physics, it has a fully equipped central research laboratory which is constantly being updated.

Automatic Control is one of today's most active technical fields. It plays an important role in national defense; in particular, it has a wide range of applications in aeronautical and aerospace technologies, research and utilization of nuclear energy, telemetry and command, control technologies, etc. The curriculum of the Automatic Control Department includes mathematical modeling, signal detection, processing, and identification, as well as theoretical and practical methods for implementing control strategies and various types of automatic monitoring, regulating and control systems. The subject of automatic control is closely related to the science of electronic computers. Currently, it offers the following specializations: ballistics, trajectory and guidance, flight control, statistical analysis of test data, and industrial control.

Electronic technology plays an essential part in the development of almost all modern technologies, particularly space science and aerospace technology. For example, the effectiveness of guided missiles and spacecraft is enhanced by using onboard radars, radio remote control and remote sensing equipment; in military communication, intelligence and command systems, digital communication equipment, signal processing and display equipment are widely used to improve the speed and accuracy of military command. The curriculum of the Electronic Technology Department includes: signal technologies, which cover

signal extraction, transmission, detection, processing, display, and identification; microwave technologies, which cover the radiation, propagation, transmission, and reception of electromagnetic waves and the interaction between electromagnetic waves and matter; and electronic system engineering, which covers the analysis of electronic systems on guided missiles, satellites, and various military systems, optimum design techniques, and other key issues in system engineering. The newly built signal processing laboratory, the microwave absorption chamber, and the microwave integrated circuit laboratory, are all modern facilities which can be used for teaching or scientific research.

Aircraft and spacecraft are expected to operate in complicated and extremely adverse environments; hence they must be constructed with materials which retain their strength under high temperature and high speed conditions. Propellants with high energy content are the energy sources of rocket propulsion. The Department of Materials and Fuels has a curriculum covering the performance and design of various new materials and fuels, as well as their applications in aerospace technology. Material science is closely related to such basic sciences such as physics of solids, solid mechanics, and chemistry. In recent years, the development of quantum mechanics and quantum chemistry has introduced new concepts to the study of relationship between material properties and structures, and to the exploration and design of new materials. Furthermore, advanced experimental and analytical techniques in physics and chemistry provided the necessary tools for these investigations. This Department has three specializations: metallic and metallic-base composite materials, non-metallic and non-metallic-base composite materials, and composite solid propellants.

Electronic computer has become a widely used tool in all aspects of modern society; it has been responsible for the development of science, economy, and military technologies, and is now an essential element in modern scientific research. In this country, electronic computer has been classified as one of eight critical technologies and has received nation-wide attention. Modern computers are advancing rapidly in the following areas: large-scale computers, micro-computers, computer networks, and artificial intelligence computers. The Department of Electronic Computers has lecture rooms and research offices designed for both software and hardware studies. It has a laboratory for conducting experiments on circuitry, logic, basic modules, and micro-processing systems; it also has a fully equipped modern factory capable of building computers of various types. Through its research projects, this Department has made important contributions which include 13 different types of computers; one of these was a central computer used onboard a data-collection ship during a rocket test in the Pacific.

In national defense, the timely completion of large scale and complex projects often involves large expenditure of man power, materials, and money. To achieve the project goal in an optimum manner, it is necessary to approach the task from an overall system viewpoint, and to apply modern scientific techniques in the planning, design, manufacture, testing, utilization, control, and management of systems which contain machine as well as human elements. The use of engineering techniques to solve system-related problems is called "systems engineering." It is a field which encompasses many different

engineering disciplines, e.g., information system engineering, aircraft system engineering, etc. Each discipline has its unique technical basis, but they all share certain common theoretical disciplines which include operations research, computational techniques, and behavioral science. The Department of System Engineering and Mathematics is established to train research scientists and engineers in the following specializations: information system engineering and flight vehicle system engineering. The Department also has a specialization in applied mathematics, whose objective is to take problems from various scientific and engineering disciplines and formulate them as general mathematical problems; solutions to the mathematical problems are then used to solve the actual engineering problems. The major areas of study in this specialization include: computational methods, operations research, and probability and statistics. Students in this specialization not only acquire a solid foundation in pure mathematics, but are also trained in applied mathematics courses such as computer languages, computational methods, applied software, linear and non-linear programming, graph theory, queuing theory, measure and decision theory, fuzzy set theory, mathematical statistics, random processes, time series analysis, as well as physics, mechanics, and philosophy.

The rapid advancement in aerospace technology places increasing demands on the precision requirement for onboard equipment. To meet this demand, the Department of Precision Machinery offers specializations in computer-controlled industrial art, and non-electric automatic instrumentation. Its objective is to train research and design personnel in the areas of industrial art and instrumentation for the development of guided missiles, satellites, and spaceships. Computer-controlled industrial art is basically a specialization in mechanical manufacturing whose machining process is controlled by computers. In order to build high-precision instruments, it is necessary to use advanced techniques such as computer- or microprocessor-controlled machine tools and sophisticated machining methods. This not only results in high-precision products, but also reduces the development cycle and manufacturing cost. Non-electric automatic instrumentation is a specialization in instrumentation whose measurement process is controlled by computers. By using advanced techniques to measure and monitor the machining process, high-precision products are ensured.

The specializations of the National Defense Science and Technology University are designed to serve the high-technology and aerospace industries. We are in need of the most modern weapons to protect our country and we want to explore the mysterious outer space. These are historical missions for today's youths of China.

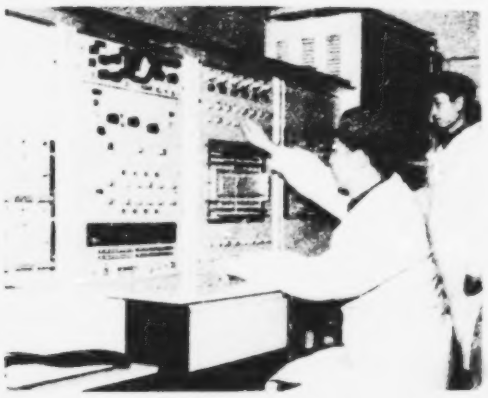
Young friends, let us establish a world view based on dialectic materialism and cultivate our morality and will power. Let us concentrate on our learning today so that we may contribute our best to the socialistic mother country tomorrow!

No matter which special field you have chosen, a solid foundation in mathematics, physics, and chemistry is essential. It is also important to have a good background in native language and be proficient in one of the foreign languages. In addition, you must devote enough time to physical fitness so you may have a healthy body to serve the Party and the people.

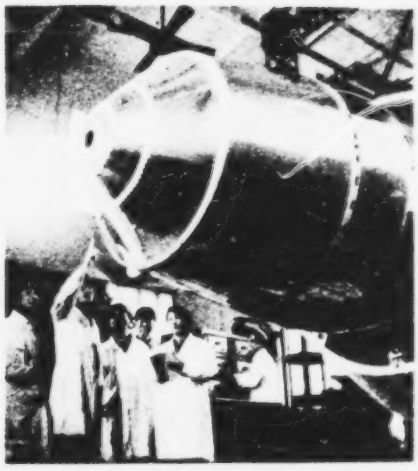
In conclusion, the National Defense Science and Technology University welcomes all of you who have made up your mind to contribute to the high-technology and aerospace industries for national defense--the generation of the 80's.

Comrades Chen Bin and Qian Xuesen offered guidance during their visit to the school

Large electron microscope



A simulation computer



Vibration testing

3012
CSO: 4008/153

AUTHOR: XU Xilin [1776 6932 2651]

ORG: None

TITLE: "China's First Large High Speed Dynamic Equilibrator"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 4, 1982 p 28

ABSTRACT: Through the cooperative efforts of Shanghai Experimental Machinery Plant, Designing Research Academy No 2 of the First Ministry of Machinery, Shanghai Transportation University, Shanghai Steam Engine Plant, and Shanghai Electrical Machinery Plant, China's first 200-ton high speed dynamic equilibrator has been successfully made. Its technical certification has been completed and its major technical property indices have been judged to be close to or the same as the level of similar products made in foreign countries. Its balancing rotors have a range of weight of 15-200 tons. The maximum length of the rotors reaches 18 m and the maximum diameter 6.1 m. The maximum balancing speed is 3,600 rotations/minute and the highest rotation speed of hypervelocity experiment is 4,320 rotations/minute. It is suitable for high speed dynamic balancing and hypervelocity tests of large capacity steam turbines, and generator rotors. Its successful manufacture has important significance for China's industry of manufacturing turbogenerators.

AUTHOR: MA Zulin [7456 4371 2651]

ORG: None

TITLE: "Precision Photoelectric Pyrometer"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 4, 1982 p 28

ABSTRACT: Yunnan Instrument and Meter Plant, Harbin University of Engineering, and Chinese Academy of Metrological Science have succeeded in making a new standard temperature measuring instrument-- the precision photoelectric pyrometer. It is suitable for 800-2,300 °C high temperature scale transmission and precision measurement. Highly sensitive multiplier phototube is used as the detector, with a spectral transparency, half-width 100 Å interference filter. When it is used to measure an object of 1100 °C, the resolution factor is ±0.1 °C, and a re-appearance rate is ± 0.5 °C. Compared with the photo-pyrometers used in China in the past, it is 5 times more sensitive, and the comprehensive errors are reduced to half. The instrument has been certified. Its major technical indices are judged to have reached the technical level of similar products made in foreign countries. It is now being manufactured by Yunnan Instrument and Meter Plant.

6168
CSO: 4009/322

AUTHOR: ZHOU Shoumei [0719 1108 4168]

ORG: Design Research Academy No 3, Ministry of Agricultural Machinery

TITLE: "Field Survey Report on Electrical Control System for Transfer Machines: I"

SOURCE: Dalian ZUHZEICHUANG [MODULAR MACHINE TOOLS] in Chinese No 4, 25 Apr 82 pp 2-5

ABSTRACT: Among the electric control systems for automatic machining in China, there are relay control system, sequencial controller, computer, programmable sequential controller (quasi-computer) systems. Due to the fact that electronic technology is not yet popularized in factories, not very many organizations adopt the electronic sequential controller system. As the cost of relay control system is low and its operation stable, it is extremely popular. Of the 477 existing automated machining lines in the country, nearly 266 lines use this type of control. The condition of application and brief comments on the cost and efficiency of the 4 types of electric control systems of the relay control system, the relay sequential controller control system, the electronic sequential controller control system, and the computer or programmable sequential controller (quasi-computer) control system constitute the major portion of the paper. Finally, in discussing the trend of future development, the paper maintains that as microprocessors are being continuously perfected, their volume reduced, their reliability improved, and their cost lowered, the computer and programmable sequential controller type will be more extensively adopted.because they may be adapted to different and complex machining processes by simply changing the system software.

6248
CSO: 4009/316

AUTHOR: SHEN Deheng [3088 1795 1854]
JIN Zhenchuan [6855 2182 1557]

ORG: Both of the Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Separation and Purification of ^{99}Tc from Acidic High Level Radioactive Liquid Waste by Anion Exchange Chromatography with NH_4CNS as Eluant"

SOURCE: Beijing HU HUAXUE YU FANGSHE HUAXUE [JOURNAL OF NUCLEAR AND RADIOCHEMISTRY] in Chinese Vol 4 No 2, May 82 pp 91-99, 80

TEXT OF ENGLISH ABSTRACT: A procedure has been developed for the separation and purification of ^{99}Tc from acidic and several other kinds of high level radioactive liquid wastes.

The feed, a simulated solution of high level liquid waste from reprocessing of spent fuel, was passed through a column with NH_4CNS as eluant, after it had been denitrated by formic acid to a pH value of 2.

The quantity of ^{99}Tc absorbed in the resin should be limited to one-fifth of full capacity on the column to give best decontamination. Other optimum conditions are: concentration of NH_4CNS, 0.6 M at pH 8.5; flow rate of eluant, less than 0.35 $ml/cm^2 \cdot min$.

[Continuation of HU HUAXUE YU FANGSHE HUAXUE Vol 4 No 2, May 82 pp 91-99, 80]

By this procedure, the radioactive nuclei, such as ^{90}Sr, ^{95}Zr-^{95}Nb, ^{137}Cs, etc., and even the most troublesome ^{106}Ru can be easily removed.

The procedure is simple, rapid and inexpensive. It has been applied to the purification of raw products of ^{99}Tc obtained from reprocessing of spent fuel with satisfactory results. The decontamination factors of ^{99}Tc from γ-emitters, ^{106}Ru-^{106}Rh, ^{125}Sb, ^{137}Cs, are 1.5×10^7, 5.0×10^7, 1.2×10^7 respectively after two cycles of operation and recovery of ^{99}Tc in the product is better than 99.9 percent.

AUTHOR: LI Shufang [2621 2579 5364]
CHEN Qiusheng [7115 4428 3932]
LU Duoying [0712 1161 5391]
et al.

ORG: All of the North China Third Research Institute

TITLE: "A Fundamental Study on the Separation of Uranium Isotopes by Ion Exchange Chromatography"

SOURCE: Beijing HU HUAXUE YU FANGSHE HUAXUE [JOURNAL OF NUCLEAR AND RADIOCHEMISTRY] in Chinese Vol 4 No 2, May 82 pp 126-inside back cover

TEXT OF ENGLISH ABSTRACT: This paper deals with the exchange reactions of U-isotopes between an aqueous solution of uranyl salt and a bed of cation exchange resin particles in a displacement chromatogram. It has been experimentally proved that when the exchange reaction of U-isotopes of uranyl ion between two phases is carried out, the U-235 isotope is enriched in the liquid phase; and then the exchange reaction between the uranyl ions and the complexes (UO_2A) in the liquid phase takes place and the U-235 isotope is enriched in the UO_2A. It has been shown that the two isotope effects mentioned above are superimposed in the separation process. Moreover, a simple model and an expression of the superimposition are given, which indicates that the slight difference between U-235 and U-238 in their ability to form the complexes is the main reason for the separation of the uranium isotopes.

9717
CSO: 4009/328

AUTHOR: SU Jielong [5685 6946 7127]

ORG: None

TITLE: "The First Symposium and Establishing Meeting on the Specialty Committee of Optical Thin Film Held in Beijing"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 3, May 82 p 203

ABSTRACT: The Chinese Society of Optics called its first Symposium on Optical Thin Film in Beijing on 4-8 Jan 82. The Optical Thin Film Specialty was officially established during the meeting. The participants of this symposium included 130 delegates representing systems of Chinese Academy of Sciences and higher education as well as 23 provinces, cities, and prefectures. The majority of them are specialists, scientists, and engineers of China having devoted a long time in the work of optical thin film. Associate Prof YUAN Youxin [5913 1635 1800] of Changchun Research Institute of Optical Precision Machinery Chinese Academy of Sciences delivered a report on "The Present Condition and Future Prospect of Optical Thin Film in China," in which, aside from the history of development of the field, he also introduced the extensive and increasing applications of optical thin film in space technology, infrared technology, laser technology, various optical instruments, and optical engineering. At present it has become an important branch of modern optics. In some aspects, Chinese studies of optical thin film have reached or been very close to the advanced level of the world and those who engage in optical thin film work total as many as 3,000-

[continuation of GUANGXUE XUEBAO No 3, 1982 p 203]

5,000 persons. The symposium received 99 papers and 24 papers were read during the meetings while 39 papers were read in separate group meetings. Four of these papers (6 percent) were on thin film theories and thin film system designing; 41 papers (65 percent) on its applications and work procedures; 16 papers (25 percent) on thin film control and test technologies. The Optical Thin Film Specialty Committee established at the symposium will contain 30 committee members and YUAN Youxin will be the chairman of the committee, which will have an office in Beijing College of Engineering.

6248
CSO: 4009/324

END

JPRS 81249

12 July 1982

China Report

SCIENCE AND TECHNOLOGY

No. 166

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12 July 1982

CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 166

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BRIEFS

OBSERVATORY NOTES SOLAR FLARES--Beijing, June 16 (XINHUA)--Astronomers at the Beijing Observatory under the Chinese Academy of Sciences Monday observed two flares on the eastern and western hemispheres of the sun. The flares occurred at 1420 hours, they said, at almost the same time, reaching their maximum simultaneously. The western flare erupted. X-ray hard radiation interferred with short-wave communications on earth for nearly an hour, they said. [Text] [OW160852 Beijing XINHUA in English 0737 GMT 16 Jun 82]

CSO: 4008/188

PARTICLE BEAM WEAPON STATE OF THE ART DISCUSSED

Shanghai ZIRAN ZAZHI [NATURE JOURNAL] in Chinese Vol 5, No 3, Mar 82 pp 214-17

[Article by Peng Yougui [1256 0645 6311], Wuhan University: "Particle Beam Weapons"]

[Text] In recent years particle beam weapons have attracted the serious attention of military sectors, and of scientists and engineers involved in military affairs in all the countries of the world. In China too, periodicals and magazines have run some articles about particle beam weapons. To give readers some further understanding of them, the present article will provide a technical critique.

So-called particle beam weapons gather charged particles (electrons or protons) that have undergone acceleration by a high energy accelerator, or neutral atoms derived from the neutralization of high energy ions, concentrate them into a beam and shoot them at almost the speed of light at a target (antiship guided missiles, antisatellite spacecraft, intercontinental and submarine-launched guided missiles). They use the accumulated energy and thermal effect of these particles to burn through their housings and set off their warhead detonation systems or damage their internal electric components, destroying or neutralizing the target.

A comparison of particle beam weapons with existing intercept weapons shows the following special characteristics: (1) Rapid intercept time. Particle beams are fired at the target at close to the speed of light, which is almost 200,000 times faster than the speed of conventional weapons. In the case of a 1,000-kilometer intercontinental missile, for example, only a few seconds are required from the time of firing of a particle beam weapon until it hits its target, while missile interception would require several minutes at minimum. (2) Powerful destructive force. Use of focused particle beam directional firing, straightness, and target roles eliminates several intermediate links of conventional weapons, thereby greatly increasing energy utilization efficiency. (3) Operation is flexible and reaction is extremely fast. By changing the field current of the magnetic control mirror, the beam's firing direction can be readily changed. As compared with laser weapons, particle beam weapons are of much greater destructive force. For example, to burn a hole in a 5mm aluminum alloy would require a laser beam impact of 1 million joules of energy per square centimeter, while a particle beam would require only 300,000 joules of energy, a

30-fold difference.[1] Furthermore, particle beams are not as easily stopped by apogee cloud layers as are laser beams; thus they have been termed all-weather weapons. Because they possess these characteristics (particularly speed, the flight time to target being virtually ignorable in calculations), they make an extremely ideal strategic defense weapon. If particle beam weapons were deployed in space and their radiation cone used to attack an adversary, their power would be equivalent to that of a large neutron bomb of equivalent weight. However, particle beam weapons also have their weaknesses. Since they must directly hit their target, accuracy requirements are extremely high. An anti-ballistic missile equipped with a nuclear warhead may err by as much as 1,000 meters, but the position accuracy of a particle beam weapon has to be within 1 meter. Particle beam weapons require extremely accurate position tracking systems and accuracy has to be able to be repeatedly corrected in the process of firing. In addition, particle beam weapons must overcome the effects of the earth's magnetic field on the launching track if it is to be able effectively to intercept the target.

Particle beam weapons may be divided on the basis of the electric charge of the particles into charged particle beam weapons and neutral particle beam weapons. On the basis of the position of the weapons facility, they may be divided into satellite-based, land-based, or ship-based particle beam weapons. On the basis of targets for attack, they may be divided into antisatellite, antiguided-missile, or anticruise missile particle beam weapons.

1. Several Key Technologies

The history of research on particle beam weapons is not a long one, and research is still in the exploratory stage. Figure 1 is a schematic drawing of an an imaginary test facility for the production of proton beam weapons, the principles underlying its functioning being as follows: Within a tightly sealed steel sphere capable of withstanding high pressure and high temperatures, a high energy plasma produced by a thermonuclear explosion is directly converted by a magnetic fluid electric power generator into electrical energy, which then goes through an energy storage converter to form high voltage pulses and produce a beam of high power density relativistic electron beams. Using the automatic resonance acceleration method, 10 kilo-ampere protons are accelerated to almost the speed of light and shot into a drift tube for experimentation to verify transmission properties of the beams in air and the destructive mechanism in relation to the target. A weapons system would include, in addition to the equipment used to produce particle beam acceleration, other components such as target tracking, acquisition, identification, target precision tracking, and guidance, coordination and communications components. The particle beams would be just a means of destroying the target. Their function would be analagous to the interception warhead of an anti-air defense missile system. The key technology for particle beam weapons may be currently generally summarized in the following five categories.

(1) Pulse Power Source

Just how much pulse energy do particle beams require to be able to attain their objective of destroying a target. Generally speaking, quantitative requirements for the pulse electric power source will be determined by the

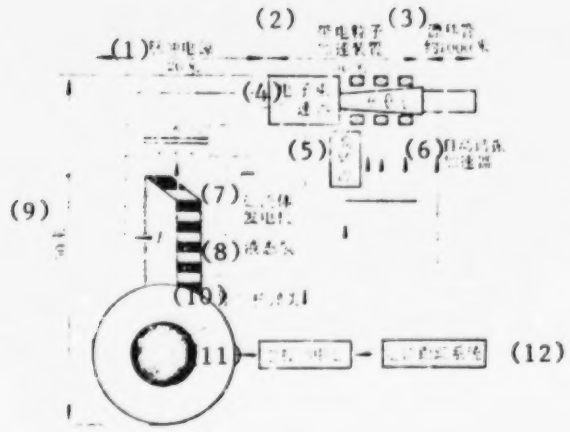

Figure 1

Key:

(1) Electric pulse source 20 meters
(2) Charged particle acceleration equipment 30 meters
(3) Drift tube about 1,000 meters
(4) Electron accelerator
(5) High frequency source
(6) Automatic resonance accelerator
(7) Magnetic fluid electric power generator
(8) Liquid hydrogen
(9) 50 meters
(10) Small nuclear warhead
(11) Main control center
(12) Position tracking system

nature of the target to be intercepted by the particle beam weapon, by the distance, transmission situation, and efficiency of the accelerator. Existing data show fairly numerous kinds of destructive effects of particle beams on targets, but mostly they are determined by the energy deposited by the particle beams on the target. (For details, see Table 1). If the pulse energy is 100 megajoules, a neutral beam launched from a satellite can burn a 10^4 square centimeter hole in a guided missile aluminum alloy housing at a distance of 1,000 kilometers. Moreover, a charged particle beam transmitted through the atmosphere requires only 10^5- 10^6 joules of pulse energy to intercept a target 1 kilometer distant.[2] If we use an energy of 1GeV, and a current of 10,000 amperes, electron beams with a pulse width of 1 microsecond can achieve the goal of destroying the aforementioned target. That means the electron beam's pulse power is 10^{13} watts, and the pulse beam's power is 10^7 joules. If the accelerator's efficiency is 30 percent, transmission efficiency not being figured in a pulse power of 3×10^{13} watts would be required. This is an astounding amount, and is 10 times the total sum of all electric power currently generated in the United States.

Just what method may be employed to accumulate such large pulse energy within a single second? Table 2 shows that by using existing electric capacitor or electric inductance methods it is absolutely impossible to satisfy weapons' needs. However, the energy from a thermonuclear explosion (each gram of TNT has a 4,000 joule energy content, and energy released by an atomic bomb is 10^3 as much; energy released from a hydrogen bomb is 10^5 as much) plus its use to drive

Table 1. Minimum Deposited Energy Computation Values for Different Destructive Effects on Several Kinds of Materials

Material	Kind of destruction	Unit energy density ε (Joules/cubic meters)
Aluminum	Melting	3,200
Chemical explosive	Detonation	250
Monocrystalline silicon wafer	Melting	7,000
Monocrystalline silicon wafer	Circuit logic disrupted	1,000
Transistor	Erroneous operation of on-off switch return circuit	25

Table 2. Comparison of Various Kinds of Energy Storage

Type	Energy density (joules/cubic meter)	Attainable energy storage	Release speed (seconds)	Pulse power ratio (watts/cubic meter)
Capacitor	(1/5) 10^2	10^7	10^{-8}	10^{10}
Inductance	(1/4) 10^4	10^8	10^{-1}	(1/4) 10^5
Impulse voltage generator	(1/4) 10^4	10^8	10^{-4}	(1/4) 10^8
Storage battery	(1/5) 10^5	10^8	10^{-3}	(1/5) 10^8
Chemical explosive	10^7	10^8	10^{-7}	10^{14}
Nuclear fission explosion	10^{10}	10^{11}	10^{-7}	10^{17}

magnetic fluid to generate electricity, or else by directly converting it into electric pulse energy for use is the way that offers most hope.

With regard to the magnetic fluid electric power generator, Figure 1 shows it to be different from the ordinary electric power generator. Its conspicuous characteristic is the omission of a prime mover and an improvement in efficiency. Reportedly the pulse fusion used in a magnetic fluid power generator in the USSR produced several hundred million joules of energy from a single reaction.[3] In order to solve problems in storage and conversion, the United States is now actively developing special electric generators that are small in bulk, light

in weight, high in power, and with a high pulse repeating frequency. They hope to be able to supply directly from an electric power generator a high voltage pulse power source to drive a charged particle accelerator.

(2) High Energy Strong Current Charged Particle Accelerator

Particle beam weapons require that the particles fired possess very high speeds, i.e., sufficient power to destroy targets, and the way in which charged particles obtain high energy is the accelerator. The accelerators in operation in the world today may be roughly divided into high voltage low current accelerators and low voltage high current accelerators. Their major parameters are as shown in Table 3. but they are a long way from meeting the requirements of accelerators for particle beam weapons.

Table 3. Characteristics of Two Types of Accelerators and Particle Beam Weapon Accelerator Requirements

Parameters	High voltage, low current accelerator	Low voltage, high current accelerator	Particle beam weapon accelerator
Voltage (mega-electron volts)	1,500	15	1,000
Current (amperes)	0.025	10^5	1,000
Pulse width (nanoseconds)	1.5	0.12	100
Energy per pulse (joules)	56	1.8×10^5	10^8
Pulse repeating frequency	50 cycles per second	several times daily	$\geq$100 cycles/second
Particle beam dispersion (radians)	$\geq 10^{-5}$	$\geq 10^{-2}$	$\sim 10^{-6}$*

*1 microradian value is all that the weapon system requires outside the atmosphere; when used inside the atmosphere, dispersion will be somewhat more.

A look at available data shows that there are three ways that are most hopeful for developing accelerators to meet weapons requirements as follows: (a) cluster ion accelerators, (b) automatic resonance accelerators, and (c) linear induction accelerators. However, their common characteristic is needed for a strong current relativity electron beam source capable of generating repeated pulses.

For cluster ion accelerators, acceleration of ion clusters is done by shooting strong current pulse relativity electron beams into a drift tube full of thin background gases. The acceleration of a small amount of ions created through ionization of the background gas by the aggregate effect of large numbers of

electrons is very much like a mighty torrent lashing a submerged reef, "small bits of stone" mingling with the turbulent waves after which these "small bits of stone," which are much larger than water molecules, move with the torrent and become accelerated. This is characterized by its not being limited by "electric shock puncture" with the result that the amassed ion acceleration field can reach 10^7- 10^8 volts per centimeter, twice the order of magnitude of the acceleration field of existing accelerators. Now, Luce of the Lawrence Livermore Laboratory (LLL) in the United States uses a powerful pulse electron beam with an energy of 1 MeV, a current of 50 kilo-amperes, and a pulse width of 50 nanoseconds to shoot into an insulated anode vacuum drift chamber with perforations in the middle, thereby obtaining a 1.6 kilo-ampere proton beam at the end of a 50 centimeter long drift tube, the proton energy reaching 45 MeV. Most recent reports tell of using the cluster ion acceleration method to derive ion energy of 200 MeV and a beam strength of 16-20 kilo-amperes, the results of which are rather sizeable.[4]

For the automatic resonance accelerator, automatic resonance acceleration is a combination of the method of accelerating ordinary traveling waves and the cluster acceleration method. This differs from the acceleration of ordinary particle traveling waves as follows. The traveling wave accelerator uses an electromagnetic matrix so that the charged particles being accelerated pick up energy from the traveling wave field and become accelerated. After acceleration, the traveling wave field loses energy, and in order to guarantee continuation of acceleration, it is necessary to continue steady absorption of supplementary energy from outside energy components (such as from high powered beam modulation tubes). The automatic resonance accelerator transmits the powerful current relativistic electron beam inside the drift tube, which has an uneven longitudinal magnetizing field. On the one hand it functions mutually with the traveling waves (i.e., the modulation waves) to make the wave amplitude ever larger, and on the other hand, because of the change in density of the electron beams in transmission, the very strong electric field formed on the surface captures ions from the ionization of the background gases moving them ahead together. The ions thereby absorb energy from the traveling waves and are accelerated to high energy, while the waves also augment their energy from the electron beams. The electron beams are not simply a propagation vehicle for the waves, but also serve as a vehicle for increasing wave strength and field strength and accelerating the ions. Finally comes effectively transferring to the ions the tremendously dense energy stored in the powerful current relativistic electron beams so that the ions will accelerate to high energy.

The automatic resonance accelerator is currently one of the major developmental accelerators in use in the United States. In 1973 Sloan and Drummond of the American Research Association predicted that they could get energy of 0.5 GeV in an accelerating tube no larger than 5 meters long, the beam being a 0.5 kilo-ampere pulse proton beam.[5] Today both the United States and the USSR are actively developing this type accelerator.

The linear induction accelerator. The principle of the linear induction accelerator is to fire powerful current pulse relativistic electron beams into a vacuum drift tube with a series of acceleration gaps, thereby obtaining

acceleration. The Lawrence Livermore Laboratory-designed 50 MeV, 10^4 ampere, 100 nanosecond electron linear induction accelerator is in process of development, and it is anticipated that experiments will shortly begin on long distance transmission directed against various kinds of targets. The repeating frequency used in the experiments will be 5 to 50 times per second, the energy fired at the target each time being 1-10 million joules.[1] Theory estimates that for electron beam weapons with an energy of 500 MeV, a current strength of 10^4 amperes, a pulse width as small as 100 nanoseconds, and six repeating frequencies per second, approximately 20 pulses can hit and destroy a target at more than 1 kilometer.[2] On the basis of current electron beam accelerator technological levels, this figure can be attained with effort.

(3) Beam Transmission

Particle beam transmission is the key to whether particle beam weapons can effectively destroy targets. Because Coulomb repulsion causes charged particles to very quickly disperse or "blow off," when charged particles are transmitted in a vacuum, charged particle beams cannot be transmitted in the near vacuum of outer space. Conversely, because of collisions with air molecules that change the direction of particles when neutral particles are in the atmosphere, they can only be transmitted in outer space or in near vacuum conditions.

The main task of neutral particle beam weapons is to be based on satellites and transmit through outer space to intercept intercontinental guided missiles or space ships at a distance of more than 1,000 kilometers. If at the time they hit the target, the beam's transverse cross-sectional area is 10^4 centimeters^2, the particle beams' divergent angle will have to be less than 10^{-6} radian. Such a requirement is rather high; otherwise the weapon's function cannot be served.

When charged particle beams are transmitted in the atmosphere, the reciprocal function of high energy particles and gas molecules in the air cause energy loss, and also produces an ionization reaction and a Brehmsstrahlung reaction. The ionization reaction makes the surrounding area right next to the transmitted beams form an opposite charge and neutralizes the charged particle beam thereby overcoming the Coulomb repulsion, assuring that the beams will not be scattered in the process of transmission. The Brehmsstrahlung reaction is primarily in the forward direction. Because these two reactions heat up the air surrounding the beams causing a sudden rise in air temperature, when the air pressure drops to 0.1 atmospheres, and the air temperature rises to $\approx$3,000°C, this provides a semivacuum for the next transmission of pulse beams, thereby greatly reducing beam transmission energy loss. This is the so-called "cavity effect," which permits the charged particles to be propagated over a very great distance. It is estimated that for a 1 centimeter^2 cross sectional area in a channel 1 kilometer long a deposit of about 1.5×10^6 joules energy is required. For each kilometer the particle beams travel, the energy loss per electron is 22 MeV. 1GeV energy beams lose only 2 percent of energy. When an electron beam of 1GeV energy and 1,000 amperes is propagated in a channel to a target 1 kilometer distant, the transverse cross sectional area is expanded 4.4 fold thereby assuring use by the electron beam weapon of more concentrated energy to destroy the target. According to data provided by physics constant

tables when particle beams with a power of 1GeV are transmitted through the atmosphere, proton beams can reach 1,420 meters and electron beams 770 meters. If there is repeated pulse frequencing, the propagation distance can be greatly increased.[2]

The aforestated situations are only extrapolations from theory requiring verification. Additionally, problems of channel stability and long distance transmission have to be solved. In addition, the effects of the earth's magnetic field on charged particle transmissions is very great, causing particles being transmitted to deflect. Strength of the earth's magnetic field is a function of position and time, and changes are very great. If precision of the earth's magnetic field is one-thousandth, beam error when transmitted 1 kilometer will be 1 meter. When transmitted 1,000 kilometers, the deviation will be 1 kilometer, making it useless. Therefore, it is presently believed that charged particle beam weapons will find use mostly against targets several kilometers distant. If the laws governing deflection by the earth's magnetic field can be further understood, particle beam weapons can be used with greater precision to destroy targets.

Particle Beams and Target Function Destructive Mechanism

The mechanism whereby particle beam weapons destroy targets is in the nature of three reactions primarily. (a) Causing a hole to be turned in the target housing or burning it to bits. (b) Igniting the warhead, and (c) melting or destroying guidance or control system electronic equipment. For detailed data, see Table 1.

Charged particles possess a powerful penetrating force against light metal housings. A proton with 1 GeV energy can penetrate 60 centimeters thick aluminum, and for each increase in the order of energy magnitude, penetrating ability is increased 40-fold. A 1 GeV electron can penetrate aluminum that is 31 centimeters thick, and for each increase in order of energy magnitude, penetration ability is increased three- to four-fold. Naturally today's missile casings cannot be made 60 centimeters thick, so they are within the range of penetration of high energy particle beams. The Americans, John Parmentola and K. Tsipis believe that if a target at a distance of 1,000 kilometers is to be destroyed (by burning a hole in the missile casing) using a 200 MeV neutral particle beam, a 2×10^{21} particle with a total energy of 6×10^{10} joules would be required.[6] If a pulse beam 100 nanoseconds wide were used, a beam strength of 3×10^{9} amperes would be required, and this is presently unattainable. High energy charged particle beams are also able to cause a series of destructive reactions within the cavity of a missile. Such reactions include neutron reactions, proton reactions, high energy electron reactions, system-generated electro-magnetic pulses (SGEMP), internal electromagnetic pulses (IEMP), or shock waves and thermal waves. Their effect in destruction of the control systems' solid state circuitry would be like "cutting the cranial nerve" of the missile, paralyzing it. In addition, shock waves and thermal waves could directly bring about an explosion, the missile thereby losing its applied force or self-destructing.

(5) Position Tracking System

For particle beam weapons to score direct hits on targets, accuracy requirements are very high. It is generally believed that the high precision aiming and tracking systems used in the development of laser beam weapons can be used with particle beam weapons. The basic methods are to use radar, infrared or optical equipment to measure the target.

Since neutral particle beams do not reflect radio waves, usual radar tracking methods cannot be used; instead a laser resonance scatter method is employed. Low power laser beams excite neutral beams and measurement of the extent of excitation is used to determine the position of the particle beams.

Inasmuch as combat distances are fairly close, in the case of charged particle beam position tracking systems use of a single pulse radar system generally satisfies requirements. At the present time the United States Air Force and the Defense Department Advanced Research Planning Agency (DARPA) are jointly working on development of "space based radar. All-weather searching of large areas will be possible in future, and it will be able to provide data on targets, positions, and speeds. It is anticipated that this radar will go into use during the 1990's. By using a single sensor network, worldwide all-weather detection, tracking, identification and more accurate measurements of targets for particle beam weapons will be possible.

2. Outlook

Judged from the standpoint of physics, partical beam weapons make sense. They possess advantages that existing defensive weapons and laser weapons do not possess. The technical areas on which particle beam weapons touch are very wide, and in terms of current scientific and technical levels, there are no great impediments to their design. However, some problems exist in their deployment. Theoretically transmission distance may be several kilometers, but this has not yet been experimentally verified. Particle beam dispersion, energy attenuation, instability of transmission channels, and the effects of the earth's magnetic field on trajectory when beams are being transmitted are crucial problems for particle beam weapons that await solution. Though stored energy in existing high power pulse technology can attain 5 megajoules, and pulse power can attain 10^{14} watts, neither the speed, volume or on-off repeated frequencies can satisfy particle beam weapon requirements. Additionally, through high energy strong current charged particle accelerators, are designable in principle on the basis of existing technology, and though automatic resonance accelerators and linear induction accelerators are theoretically workable, arduous work will still be required to develop the dimensions and efficiency of accelerating equipment that fully meets weapons requirements. If solutions can be found to the several foregoing problems, the next generation can look forward to particle beam weapons as a strategic defense weapon.

Accompanying the development of particle beam weapons must come the development of nuclear-powered magnetic fluid electric power generation, and research on high energy powerful current charged particle accelerators, and aiming and tracking technology. This must inevitably give impetus to development of nuclear fusion research, laser technology, nuclear fuel production, high speed

movement transient dynamics, nuclear power, and the application to spaceflight technology of nuclear power propulsion. Thus, particle beam weapons research and development plays an important role in advancing modern science and technology.

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9432
CSO: 4008/176

SUCCESS OF 'Y-10' CALLED 'ENCOURAGING STEP FOR CIVIL AVIATION'

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 5, May 82, pp 2-3

[Article by staff reporters: "The 'Y-10,' a Chinese-Built Jet Airliner"]

[Text] The Chinese-built jet airliner, "Y-10," was successfully flight-tested in September 1980. Subsequently, additional flight tests were performed, and in December 1981, a transfer flight between Shanghai and Beijing was completed. This achievement was attributed to the persistent efforts of Chinese aeronautical scientists and engineers, government officials, and technicians; it represented an encouraging step forward in China's civil aviation development.

During a tour of the airplane at the airport, we interviewed the design engineers of the "Y-10" to find out the details of the airplane; a summary of this interview is reported below.

The prototype model 01 of the "Y-10" had been used in static destruction tests and no longer exists. It was prototype model 02 that completed the flight between Shanghai and Beijing.

The "Y-10" jet airliner was designed according to international aviation requirements. Its power plant consists of four Pratt and Whitney JT3D-7 turbofan engines suspended from the forward section of the wing. Each engine has a maximum static thrust of 8,615 kg.

Anti-fatigue measures were incorporated in the detailed design of the airplane structure. On parts which are subject to heavy load such as the landing gear, the engine supports, and the flap guiderails, special designs were used to increase the safety margin.

The wing is a single cantilever design with a double-spar, single-plate aluminum alloy structure. The quarter-chord back sweep angle is 33.5°, and the wing profile uses a "spike" airfoil design (early supercritical airfoil) with an upper reverse angle of 7°. It is equipped with leading-edge flaps and double-split trailing-edge flaps. The airplane has good take-off and landing performance and relatively low approach speed. It uses the balancing plate type inner and outer compensation ailerons for lateral control; it is also equipped with inner and outer turbulence guard plates. The use of the "spike" airfoil resulted in a relatively high drag-divergence Mach number (M_d=0.85); its maximum cruising speed can reach 974 km/hr, and its maximum-economy Mach number

for long range flight is around 0.78-0.80. Both the horizontal and vertical tails have a 35° back sweep; the angle of the horizontal tail is adjustable. The elevator and the rudder are both equipped with inner compensation.

The semi-rigid fuselage has an inverted figure "8" cross section and has 87 frames; the sealed cabin extends from frame 1 to frame 74. The passenger cabin is pressurized to 0.6 kg/cm^2. It can accommodate 149 tourist-class seats, 124 mixed-class seats (with 16 first-class seats), or 178 economy-class seats. The cockpit is designed for five crew members (pilot, copilot, engineer, navigator, and radio operator); its windshield meets the field-of-view standards of international civil aviation. Below the fuselage floor there are two luggage compartments whose capacities are 17 m^3 and 21 m^3 respectively.

The landing gears are of the forward three-point design; the forward landing gear has a two-wheel structure which can swivel 56° to the left or right, and can make a 180° turn on a 36-meter-wide runway. The main landing gear is of the four-wheel carriage design.

The control system of the airplane is operated by flexible steel cables. With the exception of the rudder and the turbulence guard plates which are operated hydraulically, all other controls are operated manually by turning the adjustment plate to deflect the control surfaces. All systems are equipped with emergency control devices.

The hydraulic system is operated at a pressure of 210 kg/cm^2; the primary system has two main pumps which are used for operating the landing gears, the flaps, the main brakes, and for controlling the front wheels and the outer turbulence guard plates; the auxiliary system has two electric pumps which are used for controlling the inner turbulence guard plates and the rudder, as well as for emergency situations.

The fuel is stored in the integrated fuel tank inside the wing and the thin-wall soft fuel tank in the mid-wing section. The maximum capacity of the fuel tanks is 51 tons; they can be filled using either a pressurized system or a gravity system. The fuel system is equipped with an emergency dumping device.

The electric system consists of four a.c. generators connected in parallel; each generator has a capacity of 30 kilo-volt-amperes at 120 or 208 volts, and operates at 400 cycles per second. There are also four 75-amp transformer-rectifiers for supplying d.c. electric power. In addition, batteries are available for emergency use.

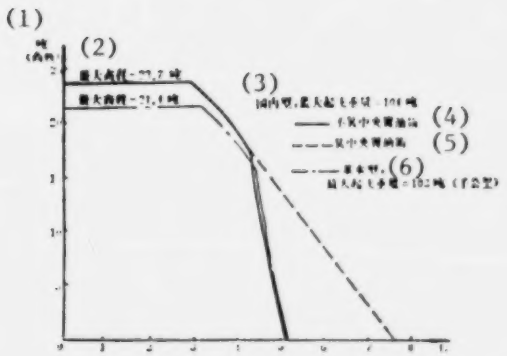
The electronic equipment include a navigation computer, a weather radar, a doppler radar, a radio compass, a landing computer with omnidirectional indicator and instrumentation, an automatic navigation apparatus, and an atmospheric-data computer. In addition, it is equipped with two shortwave single sideband transmitters, two ultra-shortwave transmitters, an S.O.S. transmitter, and an intercom system.

Key Technical Data

exterior dimensions	
wing span	42.24 m
length	42.93 m
height	13.42 m
wing area	244.6 m^2
interior dimensions	
passenger cabin length	30.4 m
width	3.48 m
height	2.20 m
weight (for domestic flight)	
maximum take-off weight	102 tons
maximum landing weight	86 tons
maximum zero-fuel weight	79.56 tons
maximum payload	21.4 tons
performance	
maximum cruising speed	974 km/hr
economy cruising speed	917 km/hr
maximum climb rate (with maximum take-off weight)	1,200 m/min
maximum cruising altitude	12,330 m
runway length for takeoff	2,070 m
runway length for landing	1,925 m

178 seats with 810 mm separation
C. lavatories S. food cabinets
F. seats for stewardesses
Z. storage

Figure 1. Passenger Cabin of the Domestic Model of "Y-10"



Key:
(1) payload
(2) maximum payload
(3) domestic model, maximum take-off weight=104 tons
(4) without midwing section fuel tank
(5) with midwing section fuel tank
(6) basic model, maximum take-off weight = 102 tons (1,000 km)

Figure 2. Payload-Range Curve of the "Y-10"

3012
CSO: 4008/178

CHINESE HUMAN DIMENSIONS AND THEIR APPLICATION IN THE DESIGN OF MOTOR VEHICLES (PART I)

Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 2, 1982

[Article by Wang Qiyuan [3769 6386 3293], Qi Huiwen [7871 1920 2429]: "The Use of Physical Dimensions of the Chinese People in the Design of Automobiles (Part I)--Brief Introduction to 'The Dimensions of the Driver's Seat of the JB-2667-80 Truck'"]

[Text] I. Physical Dimensions of the Chinese People

In our daily lives and production practices, especially in the building industry, automotive industry, aviation, dressmaking and furniture manufacturing industry that are closely related to people, height and the dimensions of the various parts of the human body are broadly utilized. It is not possible to design the driver's seat of an automobile so that the seat is appropriate, the dimensions are rational, operation is easy and convenient, and the seat is comfortable without grasping the physical dimensions of the human body and the physiological characteristics.

Our nation's regions are vast. There are many people, and the height of the people from various regions varies. How many people should be selected and measured to obtain an "average value" that is believable? Is there any fixed pattern in the distribution of the dimensions of the human body? These should all be solved using the method of "probability and statistics."

1. Sampling of Measurements of the Human Body

We know from previous data that the height of the people in our nation can be classified according to natural regions from north to south into the regions of tall, medium and short people.

The population in the region of tall people constitutes 37.39 percent of the total national population. The population in the region of people of medium height constitutes 30.26 percent and the population in the region of short people constitutes 32.35 percent.

According to date obtained in 1955 from physical examinations of citizens registering for the draft throughout the nation, the standard deviation in the average height σ is 60.1 mm. To improve precision, we take σ = 70 mm. We then take d = 5 mm. According to the formula of the sampling number in probability and statistics.

$n = (\frac{k\sigma}{d})^2$ we obtain:

When the believability of the height for men is 95 percent (K = 1.960), the number of people that we must measure is:

$$n = (\frac{k\sigma}{d})^2 = (\frac{1.960 \times 70}{5})^2 = 753 \text{ (persons)}.$$

When the believability of the height for women is 90 percent (K = 1.645), the number of people that we must measure is:

$$n = (\frac{1.645 \times 70}{5})^2 = 530 \text{ (persons)}.$$

The number of people to be measures and their distribution according to the population ratio of the regions of tall people, people of medium height and short people are shown in Table 1.

Table 1

	Men	Women	Provinces for selected Measurements
Tall people	281	198	Heilongjiang, Jilin, Liaoning
People of medium height	228	160	Zhejiang, Jiangsu, Anhui
Short people	244	172	Sichuan, Yunnan, Guangxi, Guangdong

Then, we measured a number of local people between 18 and 45 years old taking the population of the province as a ratio of the three regions of physical heights. A total of 864 men and 623 women were measured.

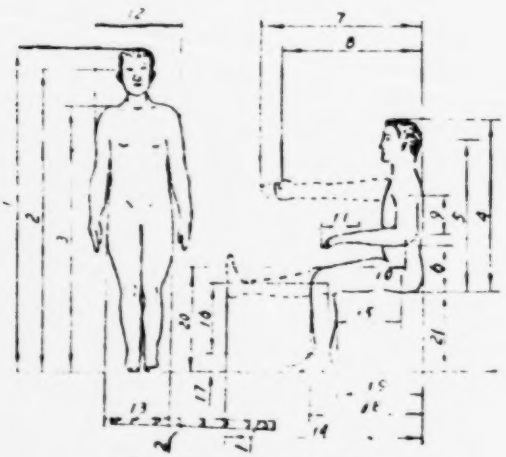


图1 人体尺寸测量项目

Diagram 1

Measurements of the dimensions of the human body

2. Measurments of the human body and results

The parts of the human body selected for measurement are determined according to the needs in driving and in designing the seat. They are mainly the external dimensions and the dimensions of joints of the four limbs.

External dimensions are mainly used to determine the interior space around the driver's seat. The dimensions of the joints of the four limbs are mainly used to determine the range of movement of the four limbs.

There are 21 measurements that have to be concretely determined, see Diagram 1.

The numerical values measured are substituted into the formulas of probability and statistics, and the "average values" and "standard deviations" are computed by computer, as listed in Table 2.

Table 2

(A) 序号	(B) 测量项目	(C) 男人		(F) 女人	
		均值 μ (D) (毫米)	标准差 σ (E) (毫米)	均值 μ (D) (毫米)	标准差 σ (E) (毫米)
1	身长	1688.25	81.83	1586.17	51.29
2	眼高	1585.32	61.61	1480.25	76.02
3	肩高	1420.98	54.35	1320.26	60.96
4	坐高	896.53	36.12	848.52	31.58
5	坐姿眼高	794		743	
6	肘到坐平面	245.23	41.81	238.63	25.63
7	上肢前伸长	837.78	36.81	784.50	37.98
8	手前伸长	730.87	47.07	688.84	36.79
9	大臂长	269.21	16.36	260.74	19.97
10	小臂长	247.08	13.22	235.93	17.03
11	手长	192.53	9.46	179.00	9.52
12	肩宽	426.32	20.35	391.77	21.67
13	臀宽	333.75	22.62	349.71	23.99
14	下肢前伸长	1015.91	58.91	976.79	50.84
15	大腿长	422.48	28.44	409.21	35.39
16	小腿长	401.34	21.57	368.60	22.21
17	足高	70.69	5.46	65.78	6.94
18	臀膝间距	550.78	27.49	527.77	31.28
19	大腿半长	422.92	23.31	431.76	30.34
20	臀上到足底	515.08	24.67	479.89	23.61
21	膝弯到足底	405.79	19 49	382.77	20.83

Key:

A Number
B Measured part
C Man
D Average value (mm)
E Standard deviation (mm)
F Woman
1 Height
2 Height of eye
3 Height of shoulder
4 Height of hips
5 Height of eye in sitting position
6 Distrance between elbow and hip
7 Length of foward extended upper limb
8 Length of forward extended fist
9 Length of upper arm
10 Length of forearm
11 Length of hand
12 Width of shoulder
13 Width of buttocks
14 Length of forward extended lower limb
15 Length of thigh
16 Length of shank
17 Height of foot
18 Distance between knee and buttocks
19 Average length of thigh
20 Distance between the top of knee and sole of foot
21 Distance from bend of knee to sole of foot

Do the measured results reflect the objective reality of the dimensions of the human body of the Chinese people? Does X represent the centralized tendency of the body of the Chinese people? This problem can be examined on the "normal probability paper."

Taking the height of the male as an example, the measured data can be divided into 22 groups according to height. The number of people in each group, the cumulative number of people, and the cumulative percentages calculated statistically are shown in Table 3.

On the "normal probablity paper" (See Diagram 2), the ordinate represents the statistical percentage of the number of people, and the abscissa represents height. We can see from the diagram that except for the first three points in Diagram 2 which show a slight deviation because of the fluctuation of data, the rest of the points are basically in a straight line. Therefore, it shows that:

(1) the distribution of the dimensions of the human body is a normal distribution;

(2) the sampling number for the measurements is sufficient and the results are correct, reflecting the objective situation of the body of the Chinese people.

Table 3

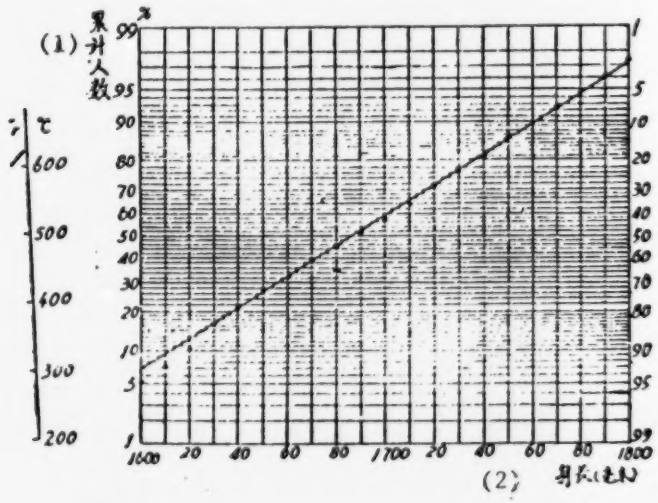
(1) 分组尺寸（毫米）	1600	1610	1620	1630	1640	1650	1660	1670	1680	1690	1700
(2) 人　　数	44	21	29	50	44	44	49	51	45	57	66
(3) 累计人数		65	94	144	188	232	281	332	377	434	500
(4) 累计百分数	5.1	7.5	10.9	16.7	21.8	26.9	32.5	38.4	43.6	50.2	57.9

(1) 分组尺寸（毫米）	1710	1720	1730	1740	1750	1760	1770	1780	1790	1800	以上 (5)
(2) 人　　数	60	58	45	40	45	25	23	23	10	10	25
(3) 累计人数	560	618	663	703	748	773	796	819	829	839	864
(4) 累计百分数	64.8	71.5	76.7	81.4	86.6	89.5	92.1	94.8	96	97.1	100

Key:

1. Group dimensions (mm)
2. Number of people
3. Cumulative number of people
4. Cumulative percentages
5. Over

Diagram 2 Examination of the normal distribution of height of males



Key:

1. Cumulative number of people
2. Height (mm)

4. Comparison of the physical dimensions of our nation's people and those of foreigners

To make it easy to compare the differences between the physical dimensions of our nation's people and the physical dimensions of the people of other nations so that the characteristics of the physical dimensions of our nation's people and the possibility of foreigners driving the newly designed automobiles can be taken into consideration, we compiled the physical dimensions of Japanese, American, West German and Russian men and listed them in Table 4.

Table 4

(1) 国别 / 数值 (毫米) (2) / 项目 (3)	中国 (16)	日本 (17)	美国 (18)	西德 (19)	苏联 (20)
(4) 身长	1688	1667	1750	1720	1715
(5) 坐高	897	907	913	900	
(6) 坐姿眼高	794		818	790	
(7) 上肢前伸长	838		879	870	
(8) 大臂长	269	284	282		320
(9) 小臂长	247	255	251		275
(10) 手长	193	183			
(11) 肩宽	431		455	450	
(12) 大腿长	422	408	462		410
(13) 小腿长	401	366	414		420
(14) 足高	71	89	83		65
(15) 膝上到足底	515	491	510	550	

Key:

1 Nationality
2 Numerical value (mm)
3 Part
4 Height
5 Height of hip
6 Height of eye in sitting position
7 Length of foward extended upper limb
8 Length of upper arm
9 Length of forearm
10 Length of hand
11 Width of shoulder
12 Length of thigh
13 Length of shank
14 Height of foot
15 Length from top of knee to sole of foot
16 Chinese
17 Japanese
18 American
19 West German
20 Russian

It can be seen from Table 4 that the Japanese are the shortest, Europeans and Americans are the tallest, and the Chinese are slightly shorter than the median height of the two. The "height of the hip" of the peoples of all the nations are about 900 mm, and the differences are not large. Therefore, in setting the interior dimensions of the automobile body, the dimensions "from the surface of the seat to the roof (body and head room)" are not visibly affected. The difference in the height of the people of the various nations is mainly found in the lengths of the lower limbs. Therefore, to enable the driver to operate and control the peddles rationally, the seat of the driver must be appropriately adjustable forward and backward.

(To be continued)

9296
CSO: 4008/146

HUMAN FUZZY CONTROL MODEL IN MAN-MACHINE SYSTEMS

Beijing YUHANG XUEBAO [JOURNAL OF CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 2, 30 Apr 82 pp 12-17

[Article by Long Shengzhao [7893 0581 3564], Jiang Qiyuan [1203 3217 6678], He Kaiyuan [0149 7030 3293] and Zhao Xu [6392 2485]]

[Text] Abstract: A fuzzy control model for human operators in man-machine systems has been developed using the theory of fuzzy sets to describe the thinking activities in the human mind (concepts, judgment, inferences and decisions, etc.). This model includes seven basic variables, which are: three fuzzy variables (membership function of error judgment, membership function of error rate judgment, membership function of control output), inference rule table, sensor and perception delay, neuromuscular lag and remnant of accidental activity, etc. The agreement between model output and the actual output of human operators has been illustrated by means of an experiment in spacecraft dynamics ($1/S^2$).

Experimental results show that the proposed model can be used to simulate the control action of operators of spacecraft, airplanes, ground vehicles, and ships. The development of this model provides a new approach for studying man-machine systems (e.g., performance prediction, design, and evaluation).

1. Introduction

One of the objects of the study of man-machine systems is the control function performed jointly by man and machine. The joint system is called a man-machine control system or manual control system, in which the human is referred to as the operator. This type of control system has a wide range of applications. In order to apply control theory to analyze this type of system, it is necessary to establish a mathematical model which characterizes the human information input and output relations. This is an important but difficult step in the analysis. Therefore, since the 1940's, the study of mathematical models for human operators has been a topic of great interest [1], and a variety of mathematical models have been developed. Currently, the most commonly used models include: transfer function model [2, 3], optimal control model [4], and time series model [5]. Each of the above models is inadequate in one way or another because human behaviors

have the ability to self-adapt and to learn; and human activities are often non-linear, time-varying, and stochastic. However, the invention and subsequent development of fuzzy mathematics provided a new approach to establish mathematical models of human responses.

It is well known that the distinct feature of a man-machine system is that it contains human elements, which in turn are controlled by thinking activities. The concept of fuzzy sets and the foundation of fuzzy set theory were proposed by Zadeh [6], who modified the theory of ordinary sets by incorporating the features of discrimination and decision-making abilities of human mind about the surroundings. Conversely, to describe human thinking activities using fuzzy set theory is not only necessary but also feasible. In this article, a model is developed to characterize the human thinking activities in a man-machine system, and its effectiveness is illustrated by a practical example.

2. Mathematical Description of the Model

In this development, we consider a man-machine system with a single degree of freedom, and assume that the dynamics of the display and control devices can be neglected. Even if they are not negligible, one can treat them as part of the controlled variables so that the derivation is completely general.

In order for a human to control the machine, he must be able to sense the control error and error rate of the system, and make a judgment based on the sensed information and the preconceived concept stored in the human brain. On the basis of the above judgment, an inference is made to decide what control strategy should be taken. Finally, the required control is produced through neuromuscular response. Because of the stochastic nature of human behavior, a remnant white noise should be superimposed on the final control output. This is the entire process of human control activities, as illustrated in Fig. 1. We assume that the following three domains of investigation are of primary interest:

E--bias error in the controlled parameter from its target value (system input) as sensed by the human operator, simply referred to as error;

R--rate of change of error sensed by the human operator, simply referred to as error rate;

C--control output generated by the human operator, simply referred to as control.

In general, when a human engages in control activities, many concepts in his thinking process are fuzzy. For example, in operating a spacecraft, if the pitch attitude of the spacecraft deviates from its target value, causing it to pitch up (with "large" or "small" error), the astronaut will respond by pushing the control lever forward (with corresponding "large" or "small" control) to return the pitch attitude to its original value. However, the concepts of "large" or "small" errors and controls are all fuzzy in the mind of the astronaut; there is no clear definition of what is meant by "large" or

"small." Nevertheless, through these fuzzy concepts, the astronaut is able to achieve a definite control objective. The situation is analogous in the control of other machines (e.g., airplanes, tanks, ships, etc.). In order to describe these fuzzy concepts, we assume that within each domain of investigation E, R, C, there are seven fuzzy sets: PB, PM, PS, ZE, NB, NM, NS, which represent the concepts of Positive Big, Positive Medium, Positive Small, Zero, Negative Big, Negative Medium, and Negative Small.

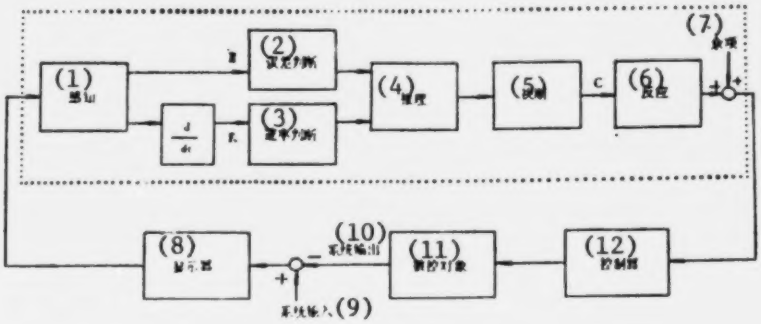


Fig. 1. The Structure of a Human Fuzzy Control Model

Key:

1. Sensation and perception
2. Error judgment
3. Error rate judgment
4. Inference
5. Decision
6. Response
7. Remnant
8. Display unit
9. System input
10. System output
11. Controlled objects
12. Control device

The combination of these fuzzy concepts with a specific domain of investigation forms seven different judgments, or seven different sets, each of which is a fuzzy variable. For example, a judgment "positive big error" is denoted by E_{PB}; the notations E_{PM}, E_{PS}, E_{ZE}, E_{NB}, E_{NM}, E_{NS} have corresponding meanings. Similarly, one can form seven judgments for the error rate: R_{PB}, R_{PM}, R_{PS}, R_{ZE}, R_{NB}, R_{NM}, and R_{NS}. Based on the physiological properties of human beings, it can be stated that human judgments are normally distributed; this fact has been verified by the experimental results of reference [7]. Therefore, both input quantities E and R are normally distributed fuzzy variables. Furthermore, we also assume that human judgments with respect to positive and negative signals are symmetrical. Thus, by using the results of reference [7], the membership function of the above fuzzy variables can be expressed as follows.

For domain E, if $e_1 < e_2 < e_3 < e_4$, then:

$$E_S(x)=\begin{cases}1, & 0<x\leq c_1,\\ e^{-\left(\frac{x-c_1}{\sigma_e}\right)^2}, & x>c_1;\end{cases}$$

$$E_M(x)=\begin{cases}e^{-\left(\frac{x-c_2}{\sigma_e}\right)^2}, & 0<x<c_2,\\ 1, & c_2\leq x\leq c_3,\\ e^{-\left(\frac{x-c_3}{\sigma_e}\right)^2}, & x>c_3;\end{cases} \qquad (1)$$

$$E_B(x)=\begin{cases}e^{-\left(\frac{x-c_4}{\sigma_e}\right)^2}, & 0<x<c_4,\\ 1, & x\geq c_4;\end{cases}$$

$$E_{ZE}(x)=\begin{cases}0, & x\neq 0,\\ 1, & x=0.\end{cases}$$

For domain R, if $r_1 < r_2 < r_3$, then:

$$R_S(x)=\begin{cases}1, & 0<x\leq r_1,\\ e^{-\left(\frac{x-r_1}{\sigma_r}\right)^2}, & x>r_1;\end{cases}$$

$$R_M(x)=e^{-\left(\frac{x-r_2}{\sigma_r}\right)^2}, \qquad x>0;$$

$$R_B(x)=\begin{cases}e^{-\left(\frac{x-r_3}{\sigma_r}\right)^2}, & 0<x<r_3,\\ 1, & x\geq r_3;\end{cases} \qquad (2)$$

$$R_{ZE}(x)=\begin{cases}0, & x\neq 0,\\ 1, & x=0.\end{cases}$$

The description of human inference activity is based on the method of reference [8], where the symbols PB, PM, PS, ZE, NS, NM, NB in the domains E, R, C are given the numerical values 3, 2, 1, 0, -1, -2, -3 respectively. During the inference process, the human thinking activity is not reflected as a singular phenomenon. We assume that the range of inference activities of human control can be approximately described by the 49 inference rules shown in Table 1, and can be represented by an expression containing a correction factor α:

$$C=-\langle aE+(1-a)R\rangle \qquad (3)$$

where α takes on values between 0 and 1; the symbol <n> represents the small integer which has the same sign as n, and whose absolute value is greater than or equal to (|n| + 0.5). A wide range of inference rules can be realized by simply adjusting the value of α.

Each rule in Table 1 represents a likelihood inference. For example, the rule represented by the (1,1) element means: "if the error and error rate are both negative big, then the control is positive big." It should be pointed out that the conclusion of the likelihood inference can be called a decision. The phrase in the above sentence "the control is positive big" is a decision. Similarly, the results of reference [7] show that this type

of decision is a normally distributed fuzzy variable and is assumed to be symmetric with respect to positive and negative values, and have seven fuzzy sets. Therefore, for domain C, if $c_1 < c_2 < c_3$, then its fuzzy sets can be expressed as:

$$
\begin{aligned}
C_S(x) &= e^{-\left(\frac{x-c_1}{\sigma_c}\right)^2}, && x>0;\\
C_M(x) &= e^{-\left(\frac{x-c_2}{\sigma_c}\right)^2}, && x>0;\\
C_B(x) &= e^{-\left(\frac{x-c_3}{\sigma_c}\right)^2}, && x>0;\\
C_{ZE}(x) &= \begin{cases} 0, & x\neq 0,\\ 1, & x=0; \end{cases}
\end{aligned}
\qquad (4)
$$

Table 1. Quantitative Representation of Inference Rule Table (α = 0.3)

		R						
		−3	−2	−1	0	1	2	3
E	−3	3	2	2	1	1	0	−1
	−2	3	2	1	1	0	0	−1
	−1	2	2	1	0	0	−1	−1
	0	2	1	1	0	−1	−1	−2
	1	1	1	0	0	−1	−2	−2
	2	1	0	0	−1	−1	−2	−3
	3	1	0	−1	−1	−2	−2	−3

On the basis of fuzzy set theory, each likelihood inference rule can be described by a fuzzy operation. For example, the rule denoted by the first element can be expressed as:

$$C_1 = E \circ (E_{NB} \times C_{PB}) \cdot R \circ (R_{NB} \times C_{PB}) \qquad (5)$$

The other rules (e.g., C_2, C_3,...C_{48}, C_{49}) can be expressed in a similar manner. Since the inference process is one of maximum likelihood selection, all the rules in Table 1 can be summarized as follows:

$$
\begin{aligned}
C = C_1 + \cdots + C_{49} &= E \circ (E_{NB} \times C_{PB}) \cdot R \circ (R_{NB} \times C_{PB})\\
&+ \cdots + E \circ (E_{PB} \times C_{NB}) \cdot R \circ (R_{PB} \times C_{NB})
\end{aligned}
\qquad (6)
$$

In equations (5) and (6), the symbols +, ·, x, o denote the fuzzy set operations open, intersection, Descartes product, and combination respectively. In fact, equation (6) summarizes the basic human thinking process (concept, judgment, inference, and decision). A complete fuzzy control model of the human operator can be obtained by adding to this procedure the human sensation-perception delay $e^{-\tau s}$, the neuromuscular lag $1/T_N S + 1$, and the accidental activity remnant r(n) (see Fig. 1). Generally speaking, the

seven parameters of this model are: the three fuzzy variables (E(x), R(x), C(x)), the inference table, the sensation-perception delay τ, the time constant of neuromuscular lag T_N, and the remnant r(n).

3. Model Examples

To illustrate the fuzzy control model for human operators, we present an experimental example of spacecraft dynamics ($1/S^2$). The experiment is as shown in Fig. 2, where the human input (with error E) and output (with control C) are recorded on a magnetic recorder. The data are then processed and reduced on a computer; the error rate R is calculated by taking the first derivative of the error E. The data sampling period is 100 seconds; and the sampling interval is 0.1 second. It should be pointed out that since the human judgment about the error and error rate are always based on data collected over a finite interval rather than the instantaneous values, a smoothing and averaging procedure (with a smoothing length of 5 points) is used in processing the data.

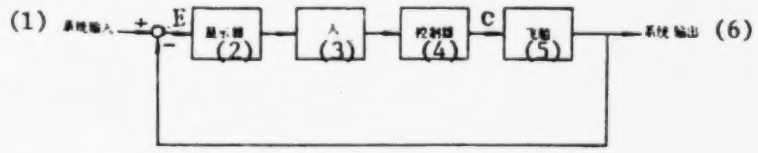


Fig. 2. Block Diagram of a Human-Spacecraft Control System

Key:

1. System input
2. Display unit
3. Human
4. Control device
5. Spacecraft
6. System output

The values of the model parameters are chosen to be: τ = 0.3 sec, T = 0.1 sec, α = 0.3. In order to improve the versatility of the model, a quantization process is applied to the E, R, and C values between zero and 2 standard deviations; also, the range of values of the fuzzy variables E and R are divided into 31 elements:

$$\{E\} = \{R\} = \{x\} = \{-15, -14, \cdots -1, 0, 1, \cdots, 14, 15\},$$

and the values of C are divided into 41 elements:

$$\{C\} = \{x\} = \{-20, -19, \cdots, -1, 0, 1, \cdots, 19, 20\}.$$

Based on the definitions of (1), (2), and (4), we selected the following parameters for the three fuzzy variables: $e_1=3, e_2=7, e_3=9, e_4=13$ $\sigma_e=1.96; r_1=2, r_2=7, r_3=12, \sigma_r=3.10; C_1=3, C_2=8, C_3=14, \sigma_C=2.14$.

Using these parameters, a comparison is made between the model output and the actual operator from experimental data. The good agreement between the

two is illustrated in Fig. 3. It is worth pointing out that these parameters have not been optimized; if parameter identification methods are used to determine the optimum parameter values, the degree of agreement should be further improved. This is a topic for future research, i.e., to solve the problem of parameter identification to improve the effectiveness of the model, and to extract the characteristic parameters of human operators.

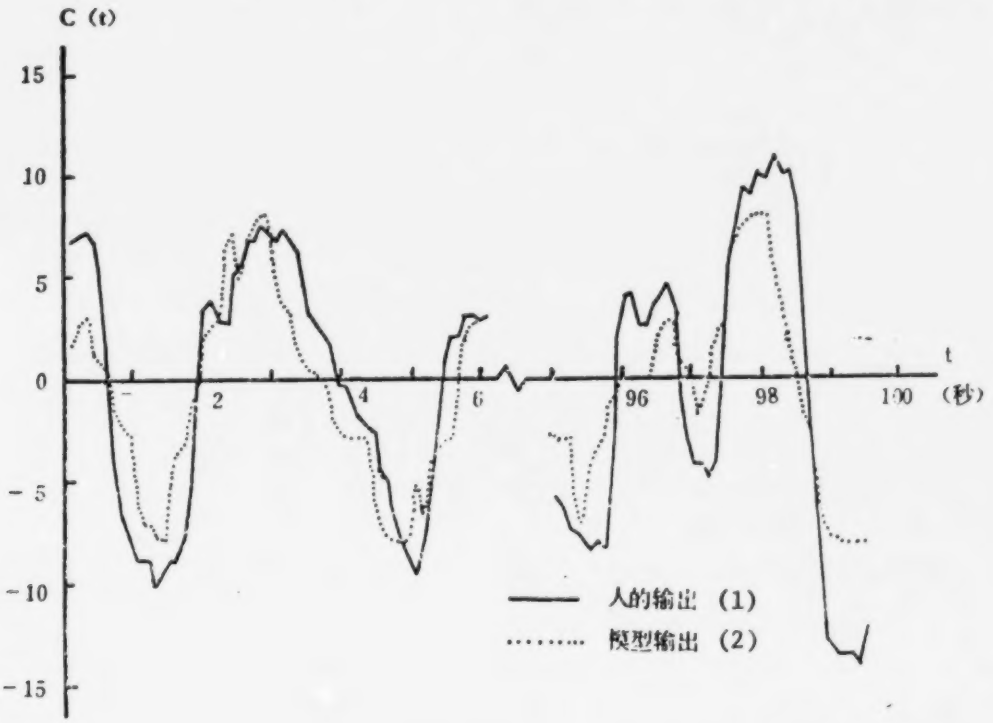


Fig. 3. Comparison Between Model Output and Actual Operator Output

Key:
1. Operator output
2. Model output

4. Conclusion

On the basis of human thinking activities, the theory of fuzzy sets has been used to develop a fuzzy control model for the human operator in a man-machine system. Experimental results show that it is feasible to use a fuzzy control model to simulate human control activities. This model can characterize the behavior of a large class of operators (e.g., operators of space shuttles, space ships, airplanes, automobiles, tanks, ships, etc.). Furthermore, the establishment of this model provides a new approach for studying man-machine systems (e.g., prediction of man-machine system performance, performance design and evaluation, etc.).

3012
CSO: 4008/170

CRITICAL ROLE OF APOGEE ENGINE IN GEOSYNCHRONOUS ORBIT EXPLAINED

Beijing HANGKONG ZHiSHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese Apr 82 pp 20-21

[Article by Da Yuan [6671 6678]: "The Apogee Engine]

[Text] Modern scientific technology has turned ancient mythology into reality. For example, geosynchronous communications satellites and early warning satellites resemble the mythical "eye that can see a thousand miles" and the "god with all-hearing ears." These satellites provide services in worldwide communications, broadcasting, relaying television transmissions, and in monitoring missile launches thousands of kilometers away. To inject this type of satellite into geosynchronous orbit depends on the apogee engine, which is activated in a transfer orbit several thousand kilometers above the earth's surface.

Orbit Injection

At one of the satellite launch sites, a giant launch vehicle rises from the ground, and one stage after another, it lifts the satellite into a predetermined orbit. Communications satellites and early warning satellites are generally geosynchronous satellites, which are in a circular orbit 36,000 km above the equator, and have a period of 24 hours. In order to make efficient use of the launch vehicle, the satellite is first launched into an elliptical transfer orbit with an apogee of 36,000 km, and having a certain inclination angle with the equatorial plane. The satellite remains in this orbit for several revolutions, during which time it performs the function of orbit and attitude adjustments. Then, when it reaches the apogee, the apogee engine is activated to give the satellite another velocity increment; the final velocity vector, which is in the equatorial plane, places the satellite in a geosynchronous orbit.

The apogee engine is much smaller than the launch vehicle engine, but it plays a critical role in the success of a satellite launch operation.

Engine Structure

The apogee engine is the heaviest component of a satellite, accounting for more than half of the total weight. The INTELSAT 3 weighs 282 kg, of which 160 kg is the apogee engine, including 140 kg of fuel. The apogee engine is

located at the center of the satellite, surrounded by other components (see Fig. 1). Currently most apogee engines used on geosynchronous satellites are solid propellant engines. This type of engine is simple structurally, operationally reliable, and relatively inexpensive. It consists of three parts: the engine housing, the propellant, and the jet nozzle (Fig. 2).

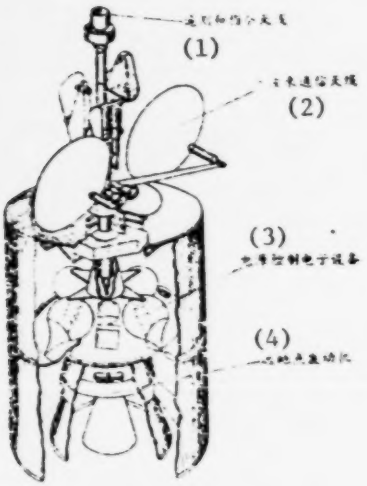


Fig. 1. The Location of Apogee Engine in a Satellite

Key:
(1) telemetry and command antenna
(2) narrow-beam communication antenna
(3) electronic power supply control unit
(4) apogee engine

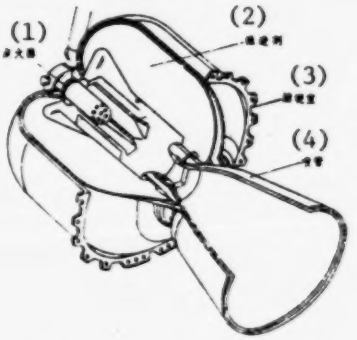


Fig. 2. The Components of an Apogee Engine

Key:
(1) igniter
(2) propellant
(3) combustion chamber
(4) nozzle

The shape of the apogee engine is dictated by the satellite structure. On a spin-stabilized satellite, the apogee engine is shaped like a large top to provide large moment of inertia about the spin axis. Even on a three-axis stabilized (earth fixed) satellite, the apogee engine is limited by the dimensions of the satellite; its shape is quite different from the elongated body of a conventional solid propellant rocket engine.

In the early days, the engine housing was made of steel alloy; later, titanium alloy and fiberglass reinforced plastic materials were used. Fiberglass or organic fiber has smaller specific gravity and high tensile strength; the use of fiberglass significantly reduces the structural weight of the engine. Currently, fiber materials are mostly used on large apogee engines, whereas titanium alloy because of its welding requirement is used on smaller engines.

Apogee engines generally use composite fuels which contain a certain proportion of aluminum powder as combustible. Under the centrifugal force generated by the satellite spin motion, the product of combustion--aluminum trioxide--is deposited in the engine housing. During the combustion process, the deposits can increase the speed of combustion; when the combustion is completed, they tend to raise the temperature of the sidewalls. Generally, the propellant of an apogee engine contains 14 to 15 percent aluminum powder. To further improve the propellant energy efficiency, the current trend is to use high-energy oxident in the propellant.

Apogee engines are generally equipped with nozzles with large expansion ratios. Thrust is generated by expanding the gas through the nozzle. The lower the ambient pressure, the more complete is the expansion, and the higher is the specific thrust (or specific impulse). In this respect the apogee engine is highly efficient because it operates in an environment with practically zero ambient pressure. The expansion ratio (ratio of exit area to throat area) of today's nozzle is approximately 50.

The apogee engine is a high-precision engine; its operational duration and thrust magnitude directly affect the precision of a geosynchronous orbit. Therefore, during the development stage, a series of high altitude simulation tests must be performed; these include simulated tests of high vacuum conditions, complex temperature field conditions, and radiation environment. These tests are necessary to ensure the reliability of engine operation.

Application and Development

Around 1963, the United States launched an experimental geosynchronous satellite called "Syncom." Its apogee engine was made of steel alloy with a mass ratio of only 0.86; the specific impulse (impulse produced per kg of propellant) was only 274 seconds. With the advancement in satellite technology, titanium alloy and fiberglass apogee engines were developed. For example, titanium apogee engines were used on the U.S. "Defense Communications Satellites," the British "Space Net" military communications satellite, the Canadian Communication Technology Satellite "CTS," and the "Geostationary Magnetic Layer Research Satellite" and "Dog Star" satellite developed by the West European nations. For small and medium size satellites, these engines can easily meet the requirements of high performance, high precision, and high degree of reliability.

Later, fiberglass reinforced plastic materials were used in the construction of apogee engines after they had been successfully tested on solid missile engines For example, the SVM series apogee engines used on the international commercial satellites, the FW-5 apogee engines used on the Canadian domestic communications satellite "Anik," as well as those used on the West European orbit test satellites and maritime satellites "Marots" were all fiberglass solid rocket engines. This type of engine not only has good technical performance but is also relatively inexpensive. Currently, its mass ratio can be as high as 0.9, and its specific impulse is around 290 seconds. The performance of the apogee engine can be further improved by using organic-fiber or carbon-fiber high-energy propellants.

In recent years, a liquid propellant apogee engine was used on the "Symphonie" communications satellite jointly developed by France and West Germany. This engine has a spherical container made of titanium alloy. The container is divided into two compartments for storing two different liquid propellants, which are forced into the combustion chamber using nitrogen gas. The engine has a specific impulse of 311 seconds. This type of engine not only has good performance, but also allows adjustment of the thrust level over a wide range, and has repeated starting capability, so that the satellite has larger flexibility in changing its orbit. This feature has attracted considerable attention in the technical community.

3012
CSO: 4008/173

BRIEFS

FUJIAN COMPUTER PARTS--Fuzhou, 24 May (XINHUA)--Beginning this year, the Fujian electronic computers plant has used domestic parts, increasing by 2.2 million yuan in costs but saving the state 1.05 million dollars in foreign exchange. In addition, it will enable related plants to increase profits by 3 million yuan. A rapidly growing enterprise, the plant has increased its annual output of computers from 5,000 sets in 1979 to 300,000 in 1981, with output value and profits up by 8.3 and 5.9 times respectively. [OW250419 Beijing XINHUA Domestic Service in Chinese 0037 GMT 24 May 82 OW]

CSO: 4008/187

SPECIALISTS ATTEND NATIONAL KIDNEY FORUM

OW021246 Beijing XINHUA in English 1229 GMT 2 Jun 82

[Text] Beijing, June 2 (XINHUA)--Specialists from Beijing, Shanghai, Nanjing and Guangzhou have agreed that the use of a medicinal herb, triterygium wilfordii, in kidney treatment can be measurably effective. About a thousand patients were treated with the herb in various parts of the country.

This was documented in their papers read at a seven-day forum on kidney diseases attended by 150 specialists from across the country, and held by the Chinese Society of Nephrology under the Chinese Medical Association. The meeting closed today.

Specialists said in their papers that they found the therapeutic effect of the herb in the treatment of kidney diseases was somewhat similar to that of steroids, but it is not a steroid and thus possesses no side effects. As a result, it has been welcomed by the steroid-dependent patients.

The herb comes from a kind of deciduous bush with small white flowers and light green leaves, grown in the central and southern parts of China, as well as Taiwan Province. The root can also be prepared as an extract, having an anti-inflammatory effect on bone joints. Doctors in China first used the herb to treat rheumatoid arthritis, then kidney diseases, both to good effect.

During the discussion, a number of the specialists held that the effect of this herb was encouraging and they suggested further study on its therapeutic effect and ways to decrease recurrence should be carried out.

Altogether there were 81 papers read at the forum, covering clinical diagnosis and treatment of glomerular diseases and kidney failure, as well as other experimental studies.

Also attending the meeting were Professor Gabrial Richet of University of Paris, president of the International Society of Nephrology; Professor Priscilla Kincaid-Smith of University of Melbourne, Australia, past president of the society, President Nael S. Bricker of University of California, president of

the 1984 International Congress of Nephrology, and Professor Kenneth Fairley of University of Melbourne. Their papers read at the meeting, dealt with clinical and pathophysiological studies of acute and chronic kidney failure, and were well received.

Experimental and pathophysiological studies on kidney diseases are a new facet of Chinese medical science.

China has used immuno-pathology and electric microscopic examination in diagnosis, kidney transplants and ambulatory dialysis in clinical treatment.

Many hospitals in the country have set up research sections and wards specially for the disease.

CSO: 4008/186

AUTHOR: ZHANG Jialu [1728 1367 7498]

ORG: Institute of Acoustics, Chinese Academy of Sciences, Beijing

TITLE: "Development of Speech Signal Processing and Speech Communication"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 3, 1982 pp 70-78

TEXT OF ENGLISH ABSTRACT: A general outline of the development of speech communication related to the techniques of speech signal processing is given briefly. The development of speech signal processing techniques was divided into three steps: 1) waveform processing; 2) parameter processing; 3) information processing. It is considered that the potentiality of waveform processing of speech is limited, the model of parameter processing of speech has to be developed, and the information processing of speech is still a virgin field.

Some methods of evaluation and diagnosis for speech transmission quality were reviewed and vast vistas of speech communication are anticipated in this paper.

AUTHOR: ZENG Xizhi [2582 6932 0037]
PAN Lihua [3382 0500 5478]
FANG Mingde [2455 2494 1795]

ORG: All of the Wuhan Institute of Physics, Chinese Academy of Sciences

TITLE: "Frequency Synthesizer for Hydrogen Atom Frequency Standard"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 3, 1982 pp 86-89

TEXT OF ENGLISH ABSTRACT: A frequency synthesizer for hydrogen atom frequency standard which has variable six digits has been developed. The frequency of this synthesizer can be changed from 405700.0000 Hz to 405799.9999 Hz with a minimum step frequency of 1×10^{-4} Hz. The measured results show that nonharmonic interrelated spurious output of the synthesizer is less than -85 dB. The measured short term frequency stabilities $\sigma(\tau)$ are 2.07×10^{-11}, 2.48×10^{-12} and 2.88×10^{-13} for averaging time of 0.1s, 1s and 10s respectively. The phase drift of the synthesizer, $\Delta\phi$, is 28.8° when the ambient temperature varies from 20°C to 40°C. No change in output phase of the synthesizer was observed when the supply-voltage varied either from +16V to +19V or from +5V to +6V. The experiments show that it can operate continuously for more than 1 month without trouble, and can operate normally for ambient temperatures from 0°C to 55°C.

AUTHOR: LIU Jiaxing [0491 0857 5281]

ORG: Southwest China Research Institute of Electronics

TITLE: "A Detector-Amplifier with a Wide Dynamic Range and High Sensitivity"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 3, o982 pp 93-96, 30

TEXT OF ENGLISH ABSTRACT: This paper presents a detector-amplifier with a wide dynamic range (about 80 dB) and high sensitivity, and discusses its characteristics of low-noise detection and amplification. The E_n-I_n noise model is analyzed, and based on this analysis the low-noise design principles are developed and three low-noise properties of the detector-amplifier are discussed. Expressions for the detecting sensitivity, dynamic range, etc., are derived by use of the modified Bessel function and the expansion of its series. Some examples of its practical application are also given.

9717
CSO: 4009/331

AUTHOR: HUANG Yukun [7806 3768 1507]
XIA Fa [1115 3127]

ORG: Both of the Department of Geology

TITLE: "The Relation Between Deep Part Structure and Seismicity of the Fault-block Region Along the Northern Coast of the South China Sea"

SOURCE: Guangzhou ZHONGSHAN DAXUE XUEBAO--ZIRAN KEXUEBAN [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS SUNYATSENI] in Chinese No 2, 1982 pp 17-25

TEXT OF ENGLISH ABSTRACT: The crustal structure characteristics of this region are: one is fault-block, the other is stratified. The seismicity in this region shows that the block-fault displacement is along the horizontal direction and that the interformational sliding is perpendicular to different layers along the fault-block. The latter principally controls the earthquakes of $M \geq 4$.

The seismic focus is distributed along the depth of 5-20 km, which is governed by different seismic layers, one of which is a Conrad surface (about 17-20 km), and the other is the lower discontinuity surface (5-8 km) of the sedimentary overlying strata.

The relative analysis is shown as follows:

[Continuation of ZHONGSHAN DAXUE XUEBAO--ZIRAN KEXUEBAN No 2, 1982 pp 17-25]

1. The earthquakes of $M \geq 4$ are essentially in the plunging edges of the folding uplift and depressive upwarped edges, which are distributed in a narrow banded zone like a sine curve along the Conrad surface.
2. The intense earthquakes are concentrated near the fold hinge point and the axial lines.
3. The characteristics of the migration of deep intense earthquakes and their space and time are rapidly advanced along adjacent symmetrical structure parts of the fold along the Conrad surface. The earthquake interval is from one to several years.
4. The intensity of seismicity is apparently increased in the coincident portions on which the active faulting zones, the sine curves of the fold hinge point of the Conrad surface and the axial lines are projected on the surface.

AUTHOR: LU Ruxiu [4151 1172 4423]
XIE Jinzhao [5509 6930 2507]

ORG: Both of the Department of Geography

TITLE: "The Research on the Law of the Maximum Rising-stage Due to the Typhoon Surge in the Pearl River Estuary"

SOURCE: Guangzhou ZHONGSHAN DAXUE XUEBAO--ZIRAN KEXUEBAN [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS SUNYATSENI] in Chinese No 2, 1982 pp 26-29

TEXT OF ENGLISH ABSTRACT: The maximum rising-stage of the Typhoon Surge of different estuarine areas and different coastal regions obeys different evolutionary laws. This paper describes the characteristics of the tidal movement and the specificity of physical geography using the comparison method to analyze the regional distribution of the maximum rising-stage.

9717
CSO: 4009/336

AUTHOR: None

ORG: None

TITLE: "Current Condition of Research and Application of Deformation Heat Treatment in China: Excerpt of First National Conference on Deformation Heat Treatment"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 5, 25 May 82 pp 9-13

ABSTRACT: Deformation heat treatment is a compound work process to cause form and phase variation simultaneously in the reinforcing procedure. This process of combining pressure processing and heat treatment can cause the material or part to have a complex property beyond the capability of a single reinforcing method. As a report of the First National Conference on Deformation Heat Treatment, without mentioning the date and place of the conference, the paper is divided into the following 3 chapters: (1) The position of deformation heat treatment in materials research and its application in metallurgical and machine industries; (2) The condition of research of the theory and application of deformation heat treatment in China; (3) Direction of research in the future. Regarding the condition of basic theoretical research, aspects of high temperature deformation toughening, room temperature deformation and deformation aging, moderate temperature deformation quenching, low temperature deformation quenching, surface deformation heat treatment, and deformation chemical heat treatment are briefly and separately reported.

6248
CSO: 4009/332

AUTHOR: CHEN Boyun [7115 2672 0061]

ORG: Department of Oceanography

TITLE: "The Species Composition and Distribution of the Planktonic Copepods in the Xisha and Zhongsha Islands, China"

SOURCE: Xiamen XIAMEN DAXUE XUEBAO ZIRAN KEXUE BAN [UNIVERSITATIS AMOIENSIS ACTA SCIENTIARUM NATURALIUM] in Chinese No 2, 1982 pp 209-217

TEXT OF ENGLISH ABSTRACT: The present study is based on material collected from the Xisha and Zhongsha Islands, including their adjacent regions, during the period from 1973 to 1975. A preliminary account was made of the species composition and the distribution of planktonic copepods in the region.

As a result of a preliminary examination of the zooplankton samples, 167 species were identified, of which 19 species are recorded for the first time from the South China Sea. The marked dominance of tropical species is clearly shown in the region studied. Among the dominant tropical species, mention should be made of such species as Undinula darwinii, Eucalanus elongatus, Euchaeta marina, Eucalanus subtenuis, etc.

On the basis of the extent of their distribution, the planktonic copepods found in the Xisha and Zhongsha Islands may be divided into four ecological groups: i.e.,

[Continuation of XIAMEN DAXUE XUEBAO ZIRAN KEXUE BAN No 2, 1982 pp 209-217]

1. eurasalinity and eurythermy group; 2. high temperature and low saline group; 3. high temperature and high saline group; 4. deep-water group.

In addition, some species show marked seasonal variation. For instance, warm-water species, such as Temora turbinata, T. stylifera, T. discaudata, etc., occur in winter and spring months. The occurrence of the above species during this period is ascribed to the influence of the Guangdong and Viet-Nan coastal current. In the summer and autumn months, tropical species become dominant due to the influence of the South Sea warm current.

AUTHOR: LIN Changjian [2651 2490 0256]
ZHUO Xiangdong [0587 0686 2639]
TIAN Zhaowu [3944 2507 2976]

ORG: All of the Department of Chemistry

TITLE: "Scanning Micro-reference Electrode Technique for Measuring the Potential and Current Distribution on Micro Areas of Metal Surface"

SOURCE: Xiamen XIAMEN DAXUE XUEBAO ZIRAN KEXUE BAN [UNIVERSITATIS AMOIENSIS ACTA SCIENTIARUM NATURALIUM] in Chinese No 2, 1982 pp 222-225

TEXT OF ENGLISH ABSTRACT: The potential and current density distribution in micro areas on metal surface is significant for studying localized corrosion. A measurement system, scanning micro-reference electrode technique (SRET), is established. The method of preparing micro-reference electrode, the auto-device for scanning electrode and the electronic circuit for automatic recording potential distribution are described.

The electrochemical behaviors of various types of localized corrosion in electrolytes and the mutual influence among active corrosion sites are investigated by SRET. According to the potential contour measured, the active and inactive sites are studied with scanning electron microscope (SEM). The initiation and propagation of localized corrosion are discussed.

9717
CSO: 4009/334

AUTHOR: ZHU Dinghua [2612 1353 5478]
SHAN Fenglan [0830 7685 5695]

ORG: Both of the Department of Physics

TITLE: "The Effect of Rare Earth Elements on the Structure and Properties of Casting High Speed Steel $W_{18}Cr_4V$"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 2, 1982 pp 64-70

TEXT OF ENGLISH ABSTRACT: If the right amount (0.1 - 0.2 percent) of rare earth elements (RE) is added into casting high speed steel $W_{18}Cr_4V$, some properties of the steel will be notable enhanced, e.g., the structure will be raised, and castability, red hardness and cutability will be improved as well. But if the steel contains RE beyond 0.2 percent, the RE inclusions will grow and the mechanical properties will be worse than those of steel without RE.

Based on the observation of cracks, it is revealed that:
1. During the fracture of casting high speed steel almost all the cracks develop along crystal boundaries and the breaking strength is very low.
2. In the steel with the right amount of RE the number of cracks developing along the boundary decreases and the cracks begin to go through the crystal, thus the breaking strength is apparently enhanced.

[Continuation of JILIN DAXUE ZIRAN KEXUE XUEBAO No 2, 1982 pp 64-70]

3. In the steel with too much RE, the majority of cracks develop through the crystals, and the breaking strength decreases, with many RE inclusions near the cracks.

AUTHOR: JI Tao [4764 3447]
CHENG Guobao [4453 0948 1405]
HAN Xiuwen [7281 4423 2429]

ORG: All of the Dalian Institute of Chemical Physics, Chinese Academy of Sciences

TITLE: "The ^{13}C-NMR Spectra Assignment for Some Alkylpyridines"

SOURCE: Changchun JILIN DAXUE ZIRAN KEXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS JILINENSIS] in Chinese No 2, 1982 pp 89-96

TEXT OF ENGLISH ABSTRACT: The broad proton decoupled and off-resonance decoupled ^{13}C-NMR spectra of eight alkylpyridines were recorded. All of the resonance lines for these compounds were fully assigned by using J.T. Clerc and Lindeman-Adams' empirical rules of chemical shifts, and the values of some empirical parameters used in the calculation of alkylpyridine chemical shift were recommended. In addition, the influence of chirality on the ^{13}C-NMR spectra was observed in a few of the alkylpyridines.

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OLD METHODS, NO COORDINATION SLOW DEVELOPMENT OF INORGANIC CHEMISTRY

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese Vol 4, No 2, 10 Apr 82 pp 31-36

[Article by Ye Bolin [5509 2672 2651] of the National Bureau of Standards: "Some Views on the Development of Inorganic Chemistry in Our Nation*"]

[Text] Many chemists in our nation believe that our nation's inorganic chemistry is a weak branch of chemical science. This situation hinders the effective utilization of our nation's abundant inorganic mineral resources, and it is a contrast to prosperous international development.

Inorganic chemistry is a classical branch of the chemical sciences. It is a science that studies the properties and the utilization of all elements in the periodic table. The discovery of the Mendeleyev periodic table enabled people to acquire a systematic and regular understanding of the elements and it promoted the development of inorganic chemistry. Since the beginning of this century, the rapid development in medicine, the dyeing industry and the petrochemical industry, in-depth studies of life phenomena, especially large biological molecules such as proteins and nucleic acids, the ever changing development of carbon-based organic chemistry (including its branch of high molecular chemistry) have attracted a large group of successful chemists. Although the atomic energy industry and the semiconductor industry have stimulated corresponding development in inorganic chemistry, but, compared to organic chemistry, its progress has been slow. Since the 1940s, traditional inorganic chemistry has changed completely as a result of the discovery and application of various types of inorganic functional materials and mutual infiltration of mathematics, physics, biology and other branches of chemistry. Some chemists at home and abroad believe that a renaissance in inorganic chemistry has arrived!

Before liberation, among the older generation of chemists of our nation, there were more people engaged in organic chemistry and physical chemistry

*This is an investigative research report. Valuable opinions and information have been provided by more than 10 scientists of the Chinese Academy of Sciences and higher educational institutions, the Chemistry Department of the Chinese Academy of Sciences and the Chinese Chemical Society.

but few engaged in inorganic chemistry. After liberation, inorganic chemistry began to develop. The 12-year science and technology development plan drawn up in 1956 established five directions for development: 1) rare elements chemistry; 2) complex chemistry; 3) inorganic synthesis; 4) physicochemical analysis; and 5) isotope chemistry. Later, the Chinese Academy of Sciences, higher educational institutions and some industrial departments established a number of research institutes (laboratories), and inorganic chemistry contributed to the detonation of our nation's two bombs. Because of the urgency of the task at the time, there was more applied research, and science itself did not realize great development. The 10-year plan drawn up in 1963 assigned separate tasks to study complex chemistry, important rare elements, nuclear fuel and our nation's unique and abundant elements. As forces were being organized and as research was being carried out systematically and profoundly, the 10 years of continuous upheaval forced a lot of work to cease. In 1977, at the National Planning Conference for the Disciplines of Natural Sciences, rare earth chemistry was included as a key point in the development of chemistry, but overall plans were not drawn up for other aspects of inorganic chemistry.

Several Existing Problems at the Present Time

1. There is a lack of unified arrangement and rational distribution. According to statistics, throughout the nation, there are over 30 higher educational institutions and 8 scientific research units that possess scientific research and teaching capabilities in inorganic chemistry. Among them, about one third are engaged in the research of rare earth elements. Very little research is being carried out in our nation's other abundant elements, tungsten, molybdenum, vanadium, titanium, antimony, lithium and boron. Research in rare earth elements mainly involves research in the chemistry of solutions, and there is very little research in the chemistry of rare earth solids which is closely related to new materials. The 15th International Rare Earth Elements Conference was held at the University of Missouri in the United States on 15 and 16 June 1981. Since the 8th and 9th conferences, over 80 percent of the papers have been on research in the chemistry of rare earth solids. Research in rare earth chemistry in our nation has not been consistent with the trends in international development. Throughout the nation, there are more than 20 units conducting research in the chemistry of rare earth solutions, 30 to 40 units conducting research in permanent magnetic rare earth materials crowded on one battlefront, each fighting its own battle, each overlapping the other, and each d veloping blindly.

2. The subjects are out-dated and there are many gaps in the field. Some comrades believe research in inorganic chemistry in our nation is too confined by tradition. Some new concepts, new fields and new methods are not given enough emphasis. Internationally, some new branches of science and active fields in inorganic chemistry such as organo-metallic chemistry, bioinorganic chemistry, chemistry of inorganic solids, inorganic structural chemistry, compounds of different metals, and non-integer ratio compounds are mostly weak or blank areas in our nation.

3. The strength is lacking and the means are backward. Throughout the nation, the strength in inorganic chemistry is far weaker than that in organic chemistry. The research strength in inorganic chemistry of the Beijing Chemical Institute was transferred entirely to study environmental chemistry. The actinium series and lanthanum series research laboratories of the Changchun Applied Chemistry Institute were completely shut down during the 10 years of upheaval. The lanthanum series elements research laboratory was reestablished as late as 1974. Several higher educational institutions once carried out research in salt lake chemistry but later they all changed. At present, there still is no special inorganic chemistry research institute in the nation. Backward means are also an outstanding problem. A lot of research is still being done with out-dated methods of the 1940s and 1950s such as spectrophotometry and thermal spectroscopy.

4. Systems are scattered, each engages in its own efforts, and there is very little mutual cooperation. Some productive departments have grasped the development and utilization of national resources but have not paid attention to basic research. The Chinese Academy of Sciences and higher educational institutions are relatively strong in basic research but this has not been emphasized and frequently they have no opportunities to make contributions.

Several Views On the Development of Inorganic Chemistry in Our Nation

I. The Emphasis of Research in Inorganic Chemistry Should Be on Combining Efforts With the Development and Utilization of Our Nation's Abundant Elements

Our nation is expansive. The known resources of inorganic minerals are very rich. The deposits of some rare and precious metals are rarely found elsewhere in the world. But, because most of our nation's abundant elements are metallic paragenetic ores, and with the long period of "singular efforts," we have neglected comprehensive utilization of the resources, and many precious elements have been lost in tailings, furnace cinder and smoke and ash. The retrieval rate is very low, and some people say now we are "throwing away the bean curd and eating the dregs of bean curd." Take rare earth elements as an example, the retrieval rate is generally 2 to 3 percent. Some people have estimated that in 1977, the retrieval rate of rare earth elements in our nation was only 1.2 percent, thus, the loss of rare earth elements each year is greater than the annual output in the United States by one magnitude. The retrieval rate of nickel, cobalt and copper is also not high. Of course, in recent years, under direct inquiry by the leading comrades of the Central Committee, and with the big help from concerned departments, the retrieval rate has increased by a relatively large scale.

The extraction of useful elements from natural elements, whether it is the extraction of elements from mineral ore in the melted state (called annealing), or the extraction of elements from solutions in the ionic state (called the wet method), or the extraction of elements by separation from mineral ore using the method of electro-deposition and the method of forming metallic gasified substances, in fact, all rely on the technological processes of certain chemical reactions. Technology is developmental research. Under ordinary conditions, there must be basic research to give it a scientific basis.

Chemistry has a bright future in developmental research in our nation's abundant elements. Inorganic chemistry should take this as the key point.

First, analysis of the change in the valence state of chemical components in mineral resources, selected ore and smelting and refining processes is the basis for comprehensive retrieval of resources. After liberation, our nation's chemical workers conducted a lot of analytical research in rare earth resources and contributed to the development of rare earth chemistry and industry. But, there are still some important mineral resources which are being developed, such as the Panzhihua Mines that contain some beneficial elements which have as yet not been reliably analyzed fully. The run and the distribution of these elements in the present processes of ore selection and smelting are still unclear. We should be able to retrieve cobalt, nickel, copper, selenium and platinum family elements from sulfide ores. At present, besides obtaining a little bit of certain elements, most are lost. The run of the platinum family elements is not completely known. The content of the rare and precious metal scandium is worth exploiting, but the best plan of comprehensive retrieval for existing production flow processes can only be proposed after the run and distribution of scandium in the processes of ore selection and smelting are known and where is scandium highly concentrated is known. Our nation's deposits of tungsten mines are world famous. The methods used to analyze tungsten ore up to now are still those used by Britain and Russia. Tungsten ore contains molybdenum and radioactive elements. The content of molybdenum in exported tungsten ore is strictly controlled. Studying good methods to analyze, concentrate and separate molybdenum and radioactive elements in tungsten ore is the unavoidable responsibility of chemical workers.

Second, the application of extraction chemistry has promoted the development of metallurgy by the wet method. At present, metallurgy by the wet method has become an important developmental trend in smelting technology. This is because foreign nations control atmospheric pollution very strictly. There is less atmospheric pollution using the wet method for smelting. Smelting by the wet method consumes less energy. The extraction of certain elements must be smelted by the wet method, or a combined production flow process of the wet method and annealing must be used to separate and extract them. The extraction of some low grade rare and precious metals must be done by the wet method because smelting by the wet method facilitates comprehensive retrieval of resources. Many of our nation's abundant elements have a complex constituency, paragenesis is compact, and the use of the wet method in smelting seems to have become more and more important. Extraction of elements in solution is the main way of separating the elements in smelting by the wet method. Recently, an international extraction conference was held in September 1980, in Belgium. The main topic of discussion was the problem of extraction in smelting by the wet method. Chemists are experts in studying the chemistry of extraction of elements in solution. The Shanghai Organic Chemistry Institute, the Changchun Applied Chemistry Institute, the Chemical Engineering and Metallurgy Institute of the Chinese Academy of Sciences and Beijing University have synthesized various types of extracting agents, studied the relationship between the structure and the properties of the extracting agents, studied the serial extraction theory which is a plan to

optimize extraction and its application in the separation and extraction of our nation's abundant elements, and they have all realized great achievements. The techniques of extracting and separating thorium and mixed rare earth elements, the techniques of extracting yttrium oxide from mixed rare earth, and studies of lithium isotopes of our nation's abundant elements are all advanced. Some have already been popularized in production and they have reached internationally advanced levels. But, the prices of extracting agents in our nation are high and this has affected the development of metallurgy by the wet method.

The application of extraction chemistry in metallurgy by the wet method has mainly been in the large number of scientific experiments to separate and extract rare earth elements in our nation. The study of other abundant elements and their popularization in production have just begun. Some chemists suggest that if the technique of optimization of serial extraction is used in the enlarged experiments to separate cobalt and nickel at our nation's Jinchuan Mines, it is possible to greatly simplify the proposed technological processes. Now, in the production flow process, if we combine the extraction method with the electro-deposition method, it is estimated that we can retrieve an additional 20,000 tons of copper a year. The study of the annealing method in smelting at the Panzhihua Mines has realized great progress, and smelting by the wet method has a bright future. The first level extraction rate of vanadium by the extraction method to extract vanadium and separate vanadium and chromium as used by the Chemical Engineering and Metallurgy Institute of the Chinese Academy of Sciences has reached over 97 percent, and the extraction rate of chromium has reached 99 percent. This method has a high efficiency in separating vanadium and chromium, it has only a few steps of extraction and back extraction and the circuit is short.

Third, research in physical chemistry of the smelting process is the basis for scientific smelting. Many of our nation's abundant elements are transition elements. An important characteristic of transition elements is that they easily form varied valences. In smelting, what is the valence state of these elements and in what types of compounds do they exist must be known, and we can only grasp the laws of their variation before we can carry out scientific smelting. For example, when Panzhihua Mines used annealing in smelting, formation of low valent titanium compounds could be suppressed only by increasing the degree of oxidation. And, the avoidance of difficulties in separating slag iron and the prevention of furnace slag from becoming viscous and from bodying due to the formation of low valent titanium compounds are possible only by increasing the degree of oxidation. Smelting by the wet method involves many problems in the physical chemistry of solutions. Some chemists believe that at present, experiments in the smelting process seldom study the mechanism of chemical reactions, the variation of the valence stage of elements, the run and distribution of the elements, thermodynamics of chemical reactions, dynamics, etc., therefore, the scientific basis is frequently insufficient, and there is a definite degree of blindness in the experiments and in production.

Fourth, the creation of some new technologies, new techniques, new methods in the smelting process must rely on breakthroughs in chemical methods. The

basis of the smelting process is a chemical problem. Breakthroughs in chemical methods can renovate traditional smelting techniques. For example, the use of fluidization techniques to reduce metals can change certain traditional techniques that use coke for high temperature reduction. The use of the new technique of plasma oxidation to manufacture high grade titanium dioxide requires simple facilities. Annealing lead easily causes lead poisoning and this is very harmful to the human body. Studies in the chemistry of water solutions of lead and the use of the wet method to replace annealing will benefit the health of workers. Besides smelting by the wet method, the technique of smelting by gasification has also developed very rapidly in recent years. It causes some metals to form halides, carboxides and alkyls in ores and these are evaporated and separated from the ores and then processed. Thus, how to combine the characteristics of our resources of abundant elements with chemical methods to provide new technologies, new methods and new techniques of smelting requires in-depth research by chemical workers.

Fifth, basic theoretical research in chemistry will open up a broad future of application of our nation's abundant elements. Some of the resources of our nation's abundant elements are exported only as raw materials or primary products at present and imported as products or semi-finished products. Our nation exports tungsten ore in large quantities at US$11,000 per ton and import large quantities of tungsten filament at US$10 million per ton. Even low grade tungsten ore is controlled by the localities and exported at very low prices. The problem of smelting tungsten has been discussed for several decades but it has not been solved for a long time.

Up to now, our nation still exports mainly fine ores of rare earth. If we can export large quantities of only one kind of rare earth oxide or one kind of permanent magnetic rare earth material or luminous rare earth material, then the price of rare earth will be increased by a thousand or a hundred times. Our nation has less nickel resources. Some people believe plated tungsten carbide is also feasible. Our nation has rich antimony resources. Besides using it to make alloys and in medicine, it is not used in many other ways. How to fully utilize our nation's resources of abundant elements, develop superiority, develop the strong points and avoid the shortcomings to accumulate more capital for national construction are questions that have a lot of potential for development. One of the reasons that has created the above situation is that our basic research is too poor. Some people believe that in applied research in rare earth elements, besides the study of catalytic synthesis of rubber using rare earth elements which can be considered a unique invention of our nation and which has been praised by international colleagues, most of the remaining research efforts imitate foreign nations and we are drawing the gourd following other people's drawings. Up to now, the rare earth elements used in our nation are all based on those used by foreign nations. Although basic physical and chemical data can be used interchangeably, the problem is that we are doing too little in this aspect, and the contribution is too small. In the application of rare earth elements over the past 10 to 20 years, a breakthrough is almost made every 2 to 3 years internationally, and some new uses are being discovered. The United States immediately began basic research in rare earth compounds after completing the work of separating single rare earth elements, and it discovered rare earth

microwave devices, rare earth red fluorescent powder for color television, luminous rare earth materials, permanent magnetic rare earth materials, and rare earth hydrogen storing materials. Some nations do not have a lot of rare earth resources, but the amount of rare earth elements being used exceeds the amount we use, and much more basic research is being done. Our nation's resources are rich, rare earth elements also possess unique physical and chemical properties. Scientists generally believe this is a treasure box of new materials that has a great potential and that is awaiting exploration. Our nation should erect our own flag of basic and creative research in rare earth elements and walk among the leaders of the world. Through the developmental research of our nation's abundant elements, we can push forward the development of some branches of chemistry in a big way. For example, we can develop rare earth chemistry, salt lake chemistry, complex chemistry of transition elements, extraction chemistry, chemical reaction engineering, and closely combine these efforts to solve urgent national tasks and to develop academic disciplines. The United States established and developed high temperature chemistry, chemical reaction thermodynamics and dynamics of many elements while solving problems in the development of its atomic energy industry. This method is worth learning.

II. We Should Pay Close Attention to, Strengthen and Develop the Study of New Branches of Science in Inorganic Chemistry

In 1976, the American Chemical Society held a conference to celebrate its 100th anniversary since its founding. The commemorative publication of the conference mentioned in its article "The Future Outlook of Inorganic Chemistry," "What will the next 100 years bring about in inorganic chemistry?" "Will chemists still have to continue their efforts in inorganic chemistry, or will they be pursuing a certain branch of science that has already been opened up today, or will they pursue still another new science that has yet to be created at present?" "Will inorganic chemistry undergo a reorganization in the next century in such a way that it will again be divided into several small and more clearly marked categories?" Although these statements do not have a clear conclusion, the meaning is very clear. They mean, inorganic chemistry of the future will have to differentiate or regroup, and many new branch sciences will emerge. This is not unfounded prognostication, it is an important developmental trend of the past 30 years in inorganic chemistry.

First, inorganic chemistry and other branches of chemistry are infiltrating each other more and more.

The most obvious is that because of the development of complex compounds, chelates, organo-metallic compounds, the gap between "inorganic" and "organic" has been gradually filled. Some nations have already broken the boundary between "organic" and "inorganic" in their categorization of the branches of chemistry. Some foreign chemists believe that "chemistry of the 21st century will be a mixture of organic and inorganic chemistry." At present, an internationally active field of research is the study of organometallic chemistry.

Before the 1950s, organo-metallic compounds were limited to the main group elements. It was generally believed that transition elements could not form stable organo-metallic compounds. In 1952, the synthesis of ferrocene sandwich activated the broad study of organic compounds of transition elements. Ernst Otto Fischer of West Germany and Geoffrey Wilkinson of Britain who synthesized ferrocene received the 1972 Nobel prize in chemistry. Later, the synthesis of compounds of sandwiched structure developed from 5 rings to 6 and 7 rings and even formed multiple layer cores, cage-like cores, etc. In addition, organo-metallic compounds of special structures such as crowns and envelopes were also discovered. The discovery and synthesis of large amounts of such types of compounds have presented new concepts and new models in the study of the theory of chemical bonds, and at the same time, many practical applications were discovered. Such compounds have a very bright future and they have become an internationally active research field. From 1963 to 1979, seven renowned chemists throughout the world received the Nobel prize in chemistry for their research in organo-metallic chemistry. But, the study of organo-metallic chemistry, compared to other branches of chemistry, is still basically a blank in our nation.

Here we must mention the question of inorganic synthesis. The study of organic synthesis and organic chemical reactions already has a history of 200 years. Fine organic synthesis and organic structural theory are already a relatively mature science. Inorganic synthesis has not yet reached such a degree of perfection. At present, hybrid inorganic and organic development will bring about some new problems in the techniques of synthesis. The synthesis of inorganic spacially structured compounds has already attracted more and more attention. Our nation's work in inorganic synthesis has not yet received widespread attention. After proposing the "Fuzhou model" of the active center of nitrogen fixing in 1977, it was not until 1979 that active substances were preliminarily synthesized according to the hypothesis of the model. At present, the study of the structure and synthesis of inorganic compounds under extreme conditions are a new field in inorganic synthesis. Chemical reactions which do not easily occur under ordinary conditions can be realized under ultrahigh temperatures, ultralow temperatures, in strong magnetic fields, under strong laser irradiation and in plasmas. This has opened up a new field in the synthesis of inorganic compounds.

Second, the mutual infiltration of inorganic chemistry and biology has produced a new branch of science called bio-inorganic chemistry.

The traditional viewpoint believed that functions in a living organism are mainly the result of organic action. This is not completely so. The living organism has more than 70 elements. Most enzymes contain metallic ions and these metallic ions exist in a complex state by combining with organic matter. Metallic ions also frequently function as active centers. During the past 10 to 20 years, people have acquired an understanding of the function of metallic ions in living organisms which chemists were unable to acquire over the past several decades of research. Now, living organisms are important sources of new knowledge and new concepts not only for biologists and organic chemists but also inorganic chemists. In 1972, the publication of

the magazine "Bio-inorganic Chemistry" marked the official birth of this new science. Bio-inorganic chemistry mainly studies the function of various elements in the system of living organisms and it studies the effects of the imbalance of trace elements upon living organisms and interference of the function of one trace element by another trace element, i.e., what is commonly called antagonism in living organisms. The imbalance of some trace elements will cause certain diseases. This has important significance in medical and biological research. Bio-inorganic chemistry also studies the mutual action between metallic ions and protein, nucleic acids, etc. People have discovered that certain metallic complexes, such as platinum complexes, possess a function of hindering cell division, and they are active in resisting the growth of tumors. Nanjing University studied quadrivalent platinum complexes and preliminarily determined that the anti-cancer mechanism is due to the action of the complex on the bonding of the alkaline radical of DNA, thus hindering DNA duplication in the cancer cell. The early evolution of living organisms occurred in the ocean. The ocean contains a rich source of elements for biological evolution. The human body is composed of about 30 elements. This is the result of gradual evolution and selection of the relatively rich source of elements in the ocean. The study of bio-inorganic chemistry will help our understanding of the origin of life. Some research in bio-inorganic chemistry has begun at some of our nation's higher educational institutions and the Chinese Academy of Sciences, but these are all scattered efforts. Systematic development of research in bio-inorganic chemistry is still in a "reading stage" of writing papers. This new field urgently needs to be deployed to catch up.

Third, physics has given strong support to the development of inorganic chemistry in theory and experimental technology on the three levels of atomic and nuclear physics, atomic and molecular physics and coacervation state physics. This is one important factor in the prosperous development of inorganic chemistry during the past several decades. The trend of development in modern chemistry is to advance from the macroscosmic to the microscopic, from state to dynamic, from the qualitative to the quantitative, from the body phase to the surface. All of these cannot be separated from the infiltration of physics. Even like such a simple crystal as sodium chloride, its microscopic structure can only be learned after it is exposed to X-rays. In 1956, two American chemists used the methods of quantum chemistry to propose the famous "symmetric conservation law of molecular orbits," and the structure of some metallic complexes were ingeniously matched in calculations and in experimental results. Research in laser chemistry discovered that the molecules of some compounds such as those of rare earth compounds possessed a multiple photon absorption effect in a strong infrared field. These molecules can dissociate without colliding in the strong infrared field. Many microscopic properties of inorganic compounds such as the arrangement of atoms, distances between atoms, surface composition, bonding, symmetry of the crystal structure are all directly related to the properties of light, sound, electricity and magnetism. At present, in the research of rare earth elements, a new field of rare earth physics has already emerged. Our nation's research in inorganic chemistry is too confined by the old traditional framework. The problem is that the infiltration of physics is too poor. There are two

reasons here: One is that workers in inorganic chemistry have a poor foundation in physics. Many comrades are confined by their old habits, and they do not pay attention to the utilization of new concepts and new methods. The second is that modern means of experimentation are too poor. Obviously, without the broad infiltration of physics, it is not possible for inorganic chemistry to realize major breakthroughs.

Fourth, the chemistry of inorganic solids and solid state physics in combination have become the two main pillars in developing new inorganic materials. The former studies the processes of chemical change in solids and control mechanisms, such as chemical changes in the processes of difussion, agglomeration and high temperature smelting, the mechanism of growth of crystals, corrosion and oxidation of solids, and electrochemical processes in solids. The latter studies the motion of atoms, electrons and lattices in solids, the effects of imperfections and impurities, etc. Because of the development in modern science and technology, the preparation of inorganic functional materials with such properties as sound, light, electricity, magnetism, heat, and force seems more and more important. During the past several decades, the synthesis of a large number of new inorganic materials has pushed development in the chemistry of solids forward. The chemistry of solids has already become an active field of research of chemistry and materials science. As early as 1965, foreign nations published special works on the chemistry of solids. In the study of new inorganic materials, our nation still mainly relies on "prescriptions," "cooking up dishes," and technological research at present. There is a lot of blindness, and very little profound theoretical research in the chemistry of solids is being done.

III. We Should Have a Uniformly Planned, Rationally Distributed Research System That Covers a Complete Range of Classifications and a Matching Depth

The research subject of inorganic chemistry includes all elements in the periodic table. Some chemists believe that our present research is centered on only a few elements while research in some important elements has not been carried out for a long period. Many comrades have proposed that research in the elements does not have to be classified as single elements. They can be considered in subgroups or types. The forces in the research of our nation's abundant elements can be strengthened and there can be more people. Appropriate forces should also be deployed in studying some ordinary elements and some "unspecific moves" can be made. We can develop rare earth chemistry through the study of rare earth elements. We can develop the chemistry of transition elements such as vanadium, titanium, tungsten, molybdenum through the study of useful elements of the Panzhihua and Jinchuan Mines. We can develop the chemistry of alkaline metals, alkaline earth metals and boron chemistry and the chemistry of concentrated solutions through the study of salt lakes. We can develop the chemistry of precious metals through the study of platinum family elements. The mineral deposits of this family of elements are scattered in our nation but their reserves may not be small. We should understand their patterns and find substitutes through research. This will simultaneously benefit comprehensive retrieval of low grade precious metallic ore in our nation. Therefore, the study of platinum family elements must be strengthened. We should develop inorganic chemistry related

to environmental pollution through the study of heavy metallic elements and other elements related to environmental pollution, etc.

In addition, division of labor must also be clearly established in the study of halide chemistry, the rare and scattered elements gallium, indium, thallium, selenium, tellurium, and actinium series elements. It is generally believed that inert gases do not participate in chemical reactions and they are an "infertile wasteland" of the periodic table undeveloped by man. In 1960, a British chemist synthesized the first xenon hexafluoroplatinate crystal. After that, the chemistry of inert gases developed prosperously. More than 1,300 papers have been published, and the chemistry of inert gases once became a fashionable research field. Up to now, nobody in our nation has studied it, and we should establish ourselves in that field.

We must also conscientiously arrange research efforts in the internationally active research fields of bio-inorganic chemistry, organo-metallic chemistry, and the chemistry of inorganic solids.

IV. We Must Pay Attention to the Mutual Connection Among Basic Research, Developmental Research, Applied Research. We Must Appropriately Evaluate the Achievements in Basic Research and Actively Solve the Problem of Corresponding Conditions

The development and study of our nation's abundant elements are strongly comprehensive. They require mutual coordination among basic research, applied research and developmental research, and they require mutual interdisciplinary and interregional cooperation. They cannot "all be studied" by one department alone. Therefore, how to appropriately evaluate the function of each unit and the various types of research work is very important. Generally speaking, intermediate experiments and industrial experiments require more effort than laboratory experiments. On the other hand, we must also fully confirm pioneering research work conducted in the laboratories. Some achievements are preludes to large industrial applications. We must respect their labor and give such achievements appropriate evaluation. It is like a person who eats three pieces of bread. We cannot credit only the third piece of bread for making the person full. In the past, some units failed to mention anything about the function of basic research after achieving success in intermediate experiments and industrial experiments. As a result, the relationship between units was affected, cooperation was affected, and the enthusiasm of engaging in necessary long-term and in-depth basic research was dampened.

It is generally believed abroad that the ratio of basic research, applied research and developmental research should be 1:2:6. Although this refers to the ratio among several types of research in a nation, this ratio shows that scientific research needs to form a system of matched depth. Mutually appropriate amount of manpower and materials must be invested at different levels before science and technology can be quickly converted into practical productive forces so that scientific research can develop its best economic effect in the national economy. Every year, the state allocates a relatively large amount of funds for the development and study of our nation's several

paragenetic mines. The funds have basically been used in applied and developmental research. But there are no funds for basic research. Especially higher educational institutions that are relatively strong in teaching and scientific research in inorganic chemistry. But because the channels were not open and there were no sources of funds, this force did not have "an opportunity to show its strength," and it was anxious but unable to do anything. This problem has been talked about for many years but it has not yet been solved well. "A skillful housewife cannot cook without rice." With a lack of necessary conditions, some basic research in our nation's abundant elements would be "idle theorizing."

9296
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SPECIAL TEAMS SCOUT DESERT FOR DEBRIS FOLLOWING ROCKET LAUNCHINGS

OW051313 Beijing Domestic Service in Mandarin 2340 GMT 4 Jun 82

[Summary] "An observation and search contingent has been operating at a base of the national defense scientific and technological commission in the depths of the Gobi Desert in China's northwest. For 20 years, the cadres and fighters of the contingent have been charged with the task of searching for the wreckage of the nose cones of various types of rockets."

When a launch vehicle leaves the ground, people always cheer for the success of its launch. However, this is only the beginning of a test. Only when the wreckage of the nose cone of the rocket is recovered by the search party in the desert area can we determine if the test is successful or not.

"Before the launch, the nose cone of a carrier rocket is bulky and heavy. It has to be lifted for installation by a special crane. However, after atmospheric friction, the debris which falls to the ground is only about the size of a hat, and some fragments are about the size of a finger." It is indeed very difficult to recover the debris from an area with a circumference of several hundred kilometers in the desert.

The cadres and fighters of the contingent have to reach the area near the point of impact several hours before the launching and sometimes have to spend a whole night in order to discover the point of impact of a launch vehicle. They have to overcome all kinds of difficulties in recovering the wreckage of a rocket, including digging in drifting sand. Led by (Zhang Xin), head of the contingent, they have been fulfilling all their difficult tasks.

Once, they went to a spot in the desert called the "death sector," a place of dunes and swamps. It was said that two members of a search team were lost in the area several years ago and that no one has ever escaped from the "death sector." However, the cadres and fighters of the contingent were not afraid of the place and conducted a careful search.

"On another occasion, they were searching for fragments which must not come into contact with a human body. Those taking part in the search activities had to wear protective clothing and helmets. They could not drink, eat, have a bowel movement or urinate. The contingent selected six strong comrades to work in the search operation for a whole day in this manner. They successfully accomplished their task."

Now many banners of honor and certificates of merit are hung on the wall of the office of the contingent.

CSO: 4008/192

COMPUTER APPLICATIONS IN CHINA DESCRIBED

Beijing BEIJING RIBAO in Chinese 30 Nov 81 p 2

[Article by Fan Youde [5400 2589 1795]: "Computer Applications in China Begin To Show Benefits"]

[Text] This reporter has learned from the recent experience exchange meeting of provincial, municipal and prefecture computer centers held in Jinan by the State Scientific and Technological Commission that many computer centers in China have applied computers to various branches of the national economy, including industry, agriculture and communication, based on the actual needs in the local area and have obtained initial economic benefits.

When applied to industry and communication, computers played an important role in improving production efficiency. The success rate of determining the location for mine shaft drilling by the Brigade No 309 of Bureau No 3 of the Second Ministry of Machine Building has been only 30 percent in the past. Each shaft drilled in the wrong location costs 200,000 yuan and the location determination has been a big problem at the brigade. The Hunan Provincial Computer Center helped them determine the location with statistical methods, such as trend analysis, and increased their success rate to 80 percent. The Shandong Provincial Computer Center helped the provincial food department make the wheat, corn and yam allocation and distribution plan for the July 1980 to June 1981 crop year. When compared to the man-made plan, the computer plan saved 210,000 yuan just from railroad transportation in Shandong Province alone.

In some areas the computer center also collaborated with agricultural and meteorological departments and applied computers to agricultural production and obtained encouraging results. The computer center at Ningxia Autonomous Region conducted a general survey of the meteorological data in Lingwu County and, based on the survey results, the county weather station made the forecast that from 1978 to 1980 the precipitation would be low and the temperature would be high in the month of April and recommended that the agricultural departments make arrangements for early watering of the spring wheat. The entire county took proper measures accordingly and, as a result, except for the production drop in 1979 due to yellow leaf disease of wheat, the county had bumper crops of wheat in 1978 and 1980, with increases of 3.6 million jin and 4.9 million jin respectively. The Zhejiang Meteorological Bureau and Longquan County Weather Station conducted a 4-year multiple-point

observation of the major meteorological factors and the rice growth in the mountainous region of Longquan County and accumulated more than 20 million pieces of data. Correlation analysis and grouping analysis done on the computer identified the relationship between the local mountain area weather change and the large regional weather, clarified the growth and adaptability of different varieties of rice at different altitudes and determined that the maximum altitude for planting rice is 600 meters (previous practice was to plant rice only up to 200 meters). County agriculture departments accepted this suggestion and planted different varieties of rice at different altitudes and thereby increased the farm land in the county by 800,000 mu and increased the crop production by 500 million jin per year.

9698
CSO: 4008/126

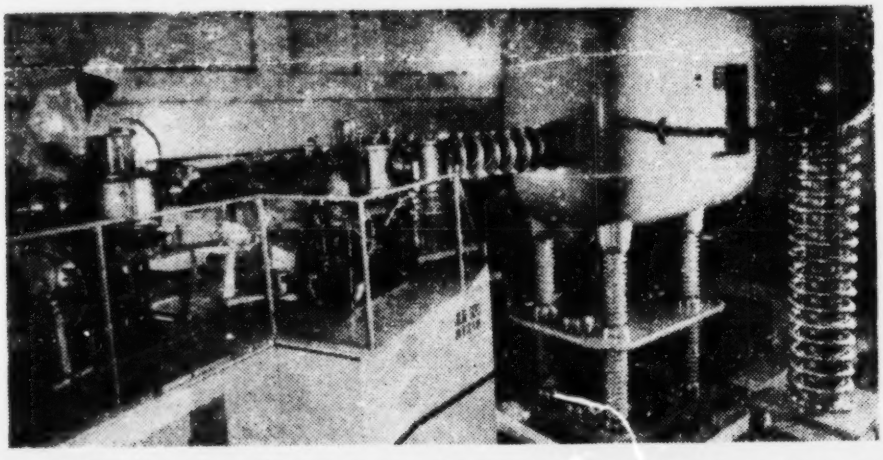
CHINA'S FIRST HIGH ENERGY PLASMA INJECTOR DESCRIBED

Shijiazhuang HEBEI RIBAO in Chinese 14 Feb 82 p 1

[Article: "China's First 600,000-volt High Energy Plasma Injector Put Into Use"]

[Text] The Hebei Institute of Semiconductors has developed China's first 600,000-volt high energy plasma injector and put it into use.

This high energy plasma injector meets advanced international standards. It is a sophisticated piece of equipment used in semiconductor research and production. It can inject light ions, such as oxygen, hydrogen, nitrogen and phosphor, and rare-earth and metallic elements into silicon, germanium and especially semiconductor compounds, such as gallium arsenide and indium phosphate, to make high quality components of a new type of structure or material. It plays an important role in the improvement of component performance and yield and in the simplification of manufacture procedure and structure format. It can be used in the research of microwave components, photoelectric components, optical integrated circuit, semiconductor compound components and large-scale integrated circuits. Hence, the successful development of the 600,000-volt high energy plasma injector has done more than fill a void in the area of semiconductor development in China.



China's first 600,000-volt high energy plasma injector developed by the Hebei Institute of Semiconductors. (Photo by Liu Zhiwei [0491 1807 0251])

The technical staff of the Hebei Institute of Semiconductors adhered to the principle that science and technology should serve economic construction and aimed at the real needs in China. After 5 years of tedious hard work, they have overcome one hurdle after another and finally succeeded in developing this piece of equipment.

9698
CSO: 4008/126

OPINIONS CONCERNING MIDDLE-AGED SCIENCE AND TECHNOLOGY PERSONNEL VOICED

Beijing GUANGMING RIBAO in Chinese 27 Feb 82 p 2

[Article by Hu Hanlin [5170 3352 7207] of the Dalian Institute of Chemical Physics, Chinese Academy of Sciences: "Bring Out the Positive Factors in Middle-aged Science and Technology Personnel"]

[Text] To ease the urgency of the personnel problem, an important task before us is to bring out the positive factors in middle-aged science and technology personnel.

There are two reasons for doing so. First, most of the science and technology personnel are now middle-aged. According to statistical figures of our institute, the average age of senior personnel is 56.8 years, intermediate level science and technology personnel have an average age of 46, and the average age of junior personnel is 39. The junior level and intermediate level people are mostly middle-aged, with an average of 42.5, and their number accounts for 81.7 percent of the total number of science and technology personnel. Second, the assume most of today's important assignments. They play the role of inheriting from their predecessors and opening up a new future. Among the intermediate level personnel in our institute, the number of research group leaders is 75.3 percent of all group leaders, and the number of laboratory directors and deputy directors is 40 percent of the total. Therefore, bringing out the positive factors in middle-aged science and technology personnel is an important and urgent task for developing personnel potential. This fact has now been realized by many comrades, but work is lagging behind in many areas and some comrades even think that middle-aged personnel are the most vocal and "hard to deal with." The middle-aged personnel are in fact the backbone of the technical force, but they are not receiving the proper attention and care. This situation has caused considerable inconvenience to middle-aged personnel and sometimes this inconvenience is not understood by others. This is the reason for their dissatisfaction which gives people the impression that they are hard to deal with.

In order to develop the positive factors in middle-aged science and technology personnel, we believe we can take the following approaches:

1. The use of talent should be flexible. Middle-aged science and technology personnel should be especially liberally employed according to the principle of merit. We should particularly avoid picking on their irrelevant weaknesses. It is inevitable that middle-aged people have some small flaws and we should never blame them for them. Sometimes a person who has no shortcomings on any account is precisely the kind of person who achieves nothing. The task of science and technology has its own special feature, namely, personnel evaluation must be related to results. Evaluating personnel without looking at the achievements is detrimental to research development. Selecting talents from science and technology personnel is different from selecting party and political workers and cannot be conducted using the same standards and methods of selecting leadership cadres.

2. We should pay more attention to middle-aged science and technology personnel politically and absorb the qualified ones into the party organization actively but prudently. Middle-aged science and technology personnel have all received long-term cultivation by the party and experienced the service tests of various political movements. Most of them have deep sentimental feeling toward the party and many of them have repeatedly applied for party membership. Some of them have been repeatedly turned down and yet they are still hopeful. Therefore, in attracting them into the party, we should set aside biases, such as family origin, social connection, rank and level of job, and the length and continuity of work experience. Whenever possible, we should avoid waiting to settle their party membership question until after they get old.

3. Pay attention to the cultivation of middle-aged science and technology personnel. In addition to regular professional improvement, cultivation is largely letting them assume responsible jobs. Professional improvement is always temporary and less extensive, whereas assuming a responsible job is long-term and extensive. It is particularly important in the improvement of standards of middle-aged science and technology personnel. Everybody has the intention of moving upward and as long as there is proper guidance, the initiative and sense of responsibility can be strengthened. This initiative and sense of responsibility constitutes a major driving force for building up trained personnel. To turn this into reality, we should be on the one hand against "confronting" middle-aged personnel and on the other hand supportive of academic democracy. This democracy is to free science and technology personnel from social bias and the suppression and restraint of "authority" while adhering to the four basic principles, and thereby insuring the development of "let a hundred schools of thought contend." Only then can we produce more and more trained personnel and achievements.

4. Difficulties in the livelihood of middle-aged science and technology personnel should be solved as high priority problems. After the downfall of the "gang of four," party policies regarding intellectuals have gradually been put on a solid basis and the living conditions of science and technology personnel have been improved. This naturally includes middle-aged personnel. Take salary, for example--all but four of the middle-aged science and technology personnel in our institute who graduated from colleges between the early 1960's and the "Cultural Revolution" have had pay raises of one to three levels and the average pay raise per person has been 13 yuan. But even so, their average salary is still only 67.76 yuan. The housing conditions of technical staff in our institute have been improved in the

past few years, with 103 families of intermediate level science and technology personnel having moved into new homes with two rooms. But today there are still 78 families of intermediate rank personnel living in single room houses, not to mention junior level personnel. With available resources, we should solve their difficulties as a high priority problem whenever possible. This is motivated by an overall interest consideration. Because middle-aged science and technology personnel are in the "golden age" of their scientific research, it is highly significant that their lives be made more comfortable so that they can concentrate on their work and produce useful results. This overall interest should be taken into consideration when policies regarding middle-aged science and technology personnel are formulated.

9698
CSO: 4008/126

BRIEFS

GEOLOGICAL MAPS BY REMOTE SENSING--Based on remote sensing and field survey data, Chen Yinxiang [7115 5593 4382], deputy director of the Remote Sensing Committee of the Chinese Geological Society, member of the National Geomorphological Mapping Committee, and chief engineer of the Remote Sensing Center of the Ministry of Geology, and his three assistants have recently compiled a total of 96 maps for the 5.8 million square kilometer region from Lanzhou and Haxat in the north to the Indian and Pakistan plains in the south, from the eastern section of the Pamirs in the west to Chengdu and Kunming in the east, including geomorphological maps of 800,000 square miles on a scale of 1:1 million, Quaternary geological maps, new tectonic movement diagrams, thermodynamic geological structure and mineral distribution maps. These are the first geological maps compiled for the Qinghai-Tibet plateau and its neighboring regions. [By Li Wei [2621 5588]] [Text] [Beijing GUANGMING RIBAO in Chinese 30 Nov 81 p 2] 9698

LOW TEMPERATURE LABORATORY--The joint establishment of a low temperature laboratory by the Institute of Physics and the Institute of Semiconductors of the Chinese Academy of Sciences has shed light on how to improve backward scientific research in China at a time of material and funding shortages. In order to develop condensed matter [ningjutai 0413 5112 1966] physics research, the Institute of Semiconductors planned to develop basic research of semiconductor optics, electricity and magnetism at low temperatures. This called for a low temperature laboratory, but the currently available facilities at the Institute of Semiconductors could not achieve the necessary low temperatures. The Institute of Physics, on the other hand, had shop facilities, equipment parts and a wealth of low temperature technological knowledge but did not have certain special equipment. After negotiations, the two institutes signed an agreement at the end of 1979 and decided to jointly establish a low temperature laboratory at the Institute of Physics and cooperate in the development of low temperature and strong magnetic field research needed badly by both institutes. The establishment of this laboratory has not only improved the utilization rate of equipment and instruments, but has also avoided repetitious imports and saved great amounts of capital for the state. In the past 2 years, these two institutes have obtained good results on joint research projects in semiconductor materials and laser components in the low temperature laboratory. [By He Chunfan [0149 2504 5672] [Excerpt] [Beijing BEIJING RIBAO in Chinese 26 Feb 82 p 2] 9698

DJM310 COMPUTER DEVELOPED--The Beijing Computer Plant No 1 has recently developed a sophisticated and versatile teaching machine--the DJM310 hybrid analog computer. The analog computer is a major class of computers. They are widely used in industrial automatic control and in the defense and research sectors. But the analog computers used for teaching in today's institutes of higher learning in China are mostly obsolete first generation machines--pure analog computers. The hybrid analog computer developed by the Beijing Computer Plant No 1 is a product between the second generation and the third generation. It is capable of high speed calculation, real-time and super real-time simulation of automation systems and can also be used for automatic optimization. It is an advanced teaching tool and can be applied to small-scale scientific research and automatic control. This hybrid analog computer has recently been approved in state appraisal and is officially under production. [By Zong Ming [1350 2494]] [Text] [Beijing BEIJING RIBAO in Chinese 21 Oct 81 p 2] 9698

CSO: 4008/126

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

TALK BY LU JIAXI OF THE CHINESE ACADEMY OF SCIENCES

Shanghai WEN HUI BAO in Chinese 21 May 82 p 1

[Article: "Expression of the Policy of the Party Central Committee on Relying on Scientists to Manage the Academy of Sciences -- Formation of New Leading Party Group in the Chinese Academy of Sciences -- Party Group Secretary Lu Jiaxi Presents Some Views on Work Arrangements for the Current Year"]

[Text] This reporter learned the following today: With the approval of the CCP Central Committee, the Chinese Academy of Sciences has formed a new leading Party group and Lu Jiaxi [4151 0857 6932] has been appointed as the Party group secretary. This Party group is the realization of the policy of the Party Central Committee to the effect that management of the Academy of Sciences should be in the hands of the scientists.

Lu Jiaxi is a famous structural chemist who is sixty-six years old this year. In May of last year, he was selected as the Director of the Chinese Academy of Sciences.

This Party group of the Chinese Academy of Sciences is composed of seven members. Hu Keshi [5170 0344 1395] and Yan Dongsheng [0917 2639 3932] are the vice-secretaries of the Party group. The previous Party group secretary Li Chang [2621 2490] is the adviser.

After the new Party group was established, Party group secretary Lu Jiaxi said the following at the cadre meeting: I am assuming my position at a time of transition in which work is under reorganization. For my part, this is a very difficult mission. I have a profound sense of the great importance of my task and I appreciate the great trust placed on me by the Party Central Committee and the expectations of my comrades. Now that the Party Central Committee has placed this burden on my shoulders, I shall bear it with all my strength and do my utmost to bear it well. He also said: The work of the Academy of Sciences must be arranged with the primary emphasis on scientific research. Under the leadership of the Party, we must unite scientific research work, professional management, administration and political ideology work under "a single cover."

In discussing the arrangement of work for this year, Lu Jiaxi emphasized the following points:

-- Positive, cautious execution of structural reform. In the first half of the year, the primary emphasis should be on readjustment and reform of Academy organs, while in the latter half of the year research will be done on structural reform of research institutes in the Beijing region. Reform of Academy organs should be centered on scientific research to achieve the objectives of organizational retrenchment, training of personnel and cadre, rapid handling of work, decrease in repetition and conveniencing primary levels.

-- Selection of outstanding cadres on the basis of requests provided by the Party Central Committee. Suitable arrangements should be made for old cadres to leave and retire. In order to decrease errors in cadre selection work as much as possible, we should hold to taking the mass line, democratic evaluation and testing the popular will; we should adhere to "appointing people on their merits"; and we should adhere to making decisions by collective discussion. We must select qualified persons and choose and recommend the able from the broad masses of cadres. If people are being used inappropriately, we will welcome everyone's criticism. At the same time, we must never forget the contributions that the old cadres made during the times of revolution. We set a high value on their self-consciously leaving and retiring and on their spirit of taking the interests of the whole into account in order to meet the requirements of furthering the revolutionary enterprise. We should make the most suitable arrangements possible for them with respect to political treatment and remuneration for their livelihood.

-- Organize for cooperation in tackling key problems. One of the most important objectives of science and technology is to serve the national economy and building of national defence. We must bring the superiority of the many scientific departments and many arms of the Academy of Sciences into full play, we must organize our selves effectively, we must adopt a positive attitude and we must get a grasp of a number of important matters in order to make the proper contributions to establishing the four modernizations for our nation. At the same time, we must work closely and cooperate with the departments concerned in tackling key problems and in solving the overall major key technical problems in establishing the nation. Basic research cannot be weakened but must advance progressively on a firm basis. Applied research must be vigorously strengthened.

-- A comparatively great advance in Party spirit must be made in the Academy of Sciences. We must ask Party members, and first and foremost Party cadres, to intensify their study, to improve their work style and to establish a good style of study and a scientific morality. At present, we should put our emphasis on the problems of organizational reform and of cooperating in tackling key problems, on establishing healthy tendencies and on criticizing erroneous ideological behavior and improper style.

In recent years, there has been a series of great reforms in the leadership system of the Chinese Academy of Sciences in such aspects as relying on scientists to manage the Academy of Sciences and realizing a democratic election system and a tenure system. The formation of the new leading Party group represents a great step forward on this foundation.

10019
CSO: 4008/179

SHANGHAI INSTITUTE OF BIOCHEMISTRY OF THE ACADEMY OF SCIENCES ELECTS NEW RESEARCH DIRECTORS

Shanghai WEN HUI BAO in Chinese 21 May 82 p 1

[Article by Zhu Kehua (2612 0344 5478) and Xu Shujian (1776 2885 0256): "Democratic Reelection of Directors at Shanghai Institute of Biochemistry -- A Group of Middle-Aged Scientific Research Personnel with Both Ability and Political Integrity Fill Leadership Posts"]

[Text] Most recently, the Institute of Biochemistry of the Chinese Academy of Sciences democratically elected the directors and vice-directors of all eight research laboratories of the institute. A group of middle-aged scientific research personnel in the prime of life with both ability and political integrity has filled the leadership posts.

This is not the first time that there has been a democratic election of laboratory directors at this institute. Institute Chief Wang Yinglai [3769 2019 4202] sincerely requested that he not serve concurrently as a laboratory director but that a younger comrade be allowed to manage the group. Twelve of the 22 newly elected vice-directors and chiefs of associated factories were elected for the first time, resulting in a lowering of the average age of the professional leadership cadres of the research laboratories and factories from 57 years to 51 years.

Before the elections, Professor Wang Debao [3769 1795 1405] was the sole director of the Second Research Laboratory, which had just participated in the first world conference on the artificial synthesis of ribonucleic acid. He was very busy, having to leave the country to give lectures and having to leave to attend meetings. He also had to take part in the concrete organization and direction of research. During the period when he was director of the Academy, he also had to concern himself with some professional work. This time, the two newly elected middle-aged assistant research personnel have assumed the duties of vice-directors of the laboratory. When Wang Debao left the country most recently, these two vice-directors actively undertook the leadership work so that scientific research work proceeded normally. After comrade Lin Qishei [2651 0366 6142] was appointed as director of three laboratories, with the assistance of the research laboratory Party branch, he established a laboratory work conference system and strengthened leadership of scientific research work. At the same time, he also gave attention to developing regular academic exchanges, assisting scientific research personnel in expanding their horizons and promoting scientific research work.

10019
CSO: 4008/179

AUTHOR: QIU Deman [6726 1795 3341]

ORG: Luoyang Glass Plant

TITLE: "Trend of Development of Glass for Automobiles in China and in Foreign Countries"

SOURCE: Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 5, 25 May 82 pp 2-5

ABSTRACT: Following a general introduction of the history of automobile glass and the types of glass used in automobiles, this paper reports the origin and development of automobile glass in China. The first toughening furnace in China was constructed in 1958 and since then toughened glass has been produced by several glass works for use as windshields of automobiles and tractors and curved windshields began to be manufactured in 1960. The productivity is still low and there is no uniformity in sizes and specifications, however. Some automobiles in China still have common heat bent windshields which are easily broken into fragments. For the purpose of standardizing automobile production, the new regulation of the Ministry of Transportation requires toughened glass for all automobiles but the supply remains deficient. Four types of safety glass, the flat toughened glass, the curved toughened glass, the flat laminated glass, and the curved laminated glass, are now being produced in China. They will soon be used to replace the ordinary heat-bent glass for all automobiles in China.

6168
CSO: 4009/339

AUTHOR: ZHANG Jingmin [1728 2417 3046]

ORG: Tianjin Electrical Drive Institute

TITLE: "A Microcomputer Control System for Blast Furnace Burden System"

SOURCE: Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese No 3, 1982 pp 21-27

TEXT OF ENGLISH ABSTRACT: This paper describes hardware, software and interfacing circuits of a microcomputer control system used for weighing error correction, and coke moisture measurement and compensation in blast furnace burden preparation.

Methods of improving reliability and interference suppressing capability have also been suggested.

AUTHOR: GAO Dianhua [7559 3013 5478]
WU Zhensheng [0702 2182 3932]

ORG: None

TITLE: "Application of ROM's in Digital Systems"

SOURCE: Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese No 3, 1982 pp 36-40

TEXT OF ENGLISH ABSTRACT: LSI ROM's have found wide use in digital systems. This paper reviews their applications in static logical and timing circuitry with the emphasis on their applications in automatic control systems and programmable telemetric systems.

9717
CSO: 4009/358

AUTHOR: LIN Shouyuan [2651 1343 6678]

ORG: Nanjing Research Institute of Electronic Technology

TITLE: "The Matching of Signal to a Network and Its Applications"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 3, 1982 pp 137-140

TEXT OF ENGLISH ABSTRACT: A new concept about the matching of a signal to a network is proposed. For an n-port microwave network, if all incident waves are proportional to the conjugates of corresponding scattering parameters of network S_{ki}^{*} ($i = 1, \ldots, n$), then the ratio of the power of scattering waves at the k-th port to the sum of the power of all incident waves reaches the maximum. Using this concept, we find some problems may be simplified when microwave networks are studied. To illustrate application of the concept, a description of an ultrabroad-band line transformer and an antenna array is given in this paper.

AUTHOR: LI Zicai [2621 1311 2088]
WANG Tianze [3769 1131 3419]
YAN Zhanggen [0917 2874 2704]
LIU Qiusheng [0491 4428 3932]

ORG: LI of the Shanghai Institute of Computing Techniques; WANG of the Beijing Electron Tube Factory; YAN of Qinghua University; LIU of Factory 4401

TITLE: "A Calculation of the Temperature Field of the Vaporization Cooling Electrode Used in High Power Electron Device"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 3, 1982 pp 192-197

TEXT OF ENGLISH ABSTRACT: The heat dissipation of anodes or collectors is one of the essential problems in the design of high power electron devices. In the past 20 years highly efficient vaporization cooling structure has been developed, but its design is still done by means of simulation or empirically. In this paper, a mathematical model for the vaporization cooling electrode and its solution are provided. The nonlinear and multi-valued properties of this mathematical physical equation are discussed. As an example, a numerical solution of the inner temperature field in a typical vaporization cooling electrode and an anode of a high power electron tube is given with a digital computer. Based on these results the design of vaporization cooling electrode and estimation of its heat dissipation capability are possible.

9717
CSO: 4009/333

AUTHOR: None

ORG: Information Office, Hangzhou Magnetic Recording Equipment Plant

TITLE: "Successful Manufacture of tye Y14A Double-sided Magnetic Disk Storage Device Test Instrument"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 6, 10 Jun 82 p 48

ABSTRACT: The Y14A doubled-sided magnetic disk storage device test instrument, successfully manufactured by Hangzhou Magnetic Recording Equipment Plant, has been certified. This instrument is made in the shape of an attache case for convenient carrying, with a 72-line rectangular pegboard. It is designed for testing, adjusting, and repairing the ZPC-201 made in China and the ISOT 1370 made in Bulgaria. The major functions of the instrument include: (1) Manual search; (2) Automatic adding "1", subtracting "1" search; (3) Between "2 addresses" search; (4) Write-in protection: (5) Write-in 8-place random code; etc.

AUTHOR: None

ORG: Shanghai Bureau of Instruments and Meters

TITLE: "Three New Product Designs Finalized at Shanghai Radio Plant No 21"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 6, 10 Jun 82 P 48

ABSTRACT: The Shanghai Radio Plant No 21 is experimenting with the 3 new products of SR53 dual track double scan oscillograph, XJ17 general purpose oscillograph, and SG1 2-line high sensitivity oscillograph. Designs of all three items have been finalized. The SR53 has a bandwidth of DC - 30MHz and such functions as totally automatic trigger synchronization, automatic focusing, etc. It is light weight, being made partially with integrated circuits. The XJ17 is a new product designed to replace the SBT-5 synchronous oscillograph produced in the 50's. The major technical indices are the same as the SBT-5 and it is 1/6 in volume and 1/6 in weight, and consumes 6/7 less power ; the price will be 13 percent lower. The SG1 will have a maximum sensitivity of 10μV/cm, the highest of all domestic oscillographs. Its major technical indices are close or equal to similar products made in foreign countries.

6248
CSO: 4009/340

AUTHOR: LI Guangzong [2621 0342 1350]
YU Jiayu [0151 1367 6877]

ORG: Both of the Research Division, Chengdu Exploration and Design Institute of Hydroelectric Power, Ministry of Water Conservancy and Electric Power

TITLE: "Behavior Analysis of the Lined Top-arch of Underground Hydro-powerhouse"

SOURCE: Nanjing YANTU GONGCHENG XUEBAO [CHINESE JOURNAL OF GEOTECHNICAL ENGINEERING] in Chinese No 2, 1982 pp 86-96

TEXT OF ENGLISH ABSTRACT: This paper presents and analyzes the long-term prototype observational data of some large underground hydro-powerhouses in China. The analysis shows that in both the distribution and the magnitude of stresses there exists a great difference between the value measured in prototype and the value designed by Protodyakonov's theory. All the reinforcement bar stresses measured in lined top-arch represent some time effect, i.e., these stresses increase steadily and slowly with the elapsed time. A visco-elastic model of K-H in series is used by the authors to analyze the rock pressure acting on a lined top-arch. In addition, some opinions for improving the design and construction of lined top-arch are suggested.

AUTHOR: LI Xiesheng [2621 0588 3932]

ORG: Chengdu Exploration and Design Institute of Hydroelectric Power, Ministry of Water Conservancy and Electric Power

TITLE: "Treatment of the Engineering Geologic Problems in the Underground Hydroelectric Power Plant of the Fisherman's Creek I"

SOURCE: Nanjing YANTU GONGCHENG XUEBAO [CHINESE JOURNAL OF GEOTECHNICAL ENGINEERING] in Chinese No 2, 1982 pp 107-118

TEXT OF ENGLISH ABSTRACT: The geological conditions of this underground hydroelectric power plant are very complex. The high angle faults, low angle faults and fractures in the same directions have developed under the influence of areal geological structures. The stability and perfection of the rock pillar between the main machine hall and the tailwater surge chamber have been spoiled by longitudinal and transversal fractures which intersected each other and dissected the rock pillar into more than 10 rock blocks. Simultaneously, some rather unstable rock masses were formed in some parts of the upstream and downstream sidewalls of the main machine hall. In addition, in consequence of the insufficiency of geological data and rock test results, the choice of the axis of the main machine hall and the layout of underground structures are not quite ideal. The density of rock chambers is very big, and the intersections of the chambers with lateral galleries totaled 19, thus enhancing the difficulty of construction of the underground power plant.

[Continuation of YANTU GONGCHENG XUEBAO No 2, 1982 pp 107-118]

Therefore, some suitable engineering structural measurements were adopted at the principal positions, such as the use of deep rock anchor piles, hollow anchor rock chambers, lateral buttress and propped beams; rectification of local layout; the adoption of a more reasonable construction schedule, and a series of constructional safety measures, such as capping, locking, anchoring, thrusting, bracing, hooping, etc. From prototype observations and the results of finite element analysis of the stress and deformation calculation of the surrounding rock, it is evident that these measures are effective and ensure the completion and safe operation of the underground power plant. Further prototype observations and investigations are still underway.

9717
CSO: 4009/357

AUTHOR: ZHANG Liming [1728 0448 2494]
LU Zukang [7120 4372 1660]
BEI Guohua [6296 0948 5478]

ORG: All of Zhejiang University

TITLE: "Laser High-speed Holography"

SOURCE: Hangzhou ZHEJIANG DAXUE XUEBAO [JOURNAL OF ZHEJIANG UNIVERSITY] in Chinese No 2, 1982 pp 115-128

TEXT OF ENGLISH ABSTRACT: A novel apparatus of laser high-speed holography is described, which mainly consists of a single-mode operating ruby laser and a light beam deflector. The laser is used as a coherent light source to produce sequential pulses. The light beam deflector is made of ZF-6/36°YLN. With this apparatus we have successfully taken the double-exposure dynamic holograms at a frequency up to 50 KHz, therefore, each picture has four to eight patterns. In the article, we discuss some fundamental questions, such as the steady operation conditions of the laser, the thermo-distortion of acoustic optical detectors and the selection of schemes for recording multiple holograms, etc. Finally, some experimental results are shown.

AUTHOR: JIN Tingzan [6855 1694 6363]

ORG: Zhejiang University

TITLE: "Design of Interactive Function in Computer Display"

SOURCE: Hangzhou ZHEJIANG DAXUE XUEBAO [JOURNAL OF ZHEJIANG UNIVERSITY] in Chinese No 2, 1982 pp 129-140

TEXT OF ENGLISH ABSTRACT: In the basic software of interactive computer display two fundamental problems must be considered. First is the graphic processing itself, such as graphic structure, storage, transformation and clipping. The author has expounded it in "Graphical Generation, Transformation and Clip in Computer Display" (JOURNAL OF ZHEJIANG UNIVERSITY, May 1980 and September 1980). The other is the interactive function design. Its feature is that the user can design interactive functions he requires, namely "light button" and "key function." In this paper, the design method on this topic with the author's practice is briefly introduced.

9717
CSO: 4009/356

AUTHOR: LUO Rutie [4382 1172 6993]

ORG: Department of Chemistry

TITLE: "A Computer Method for Generating Three-dimensional Kellogg Diagrams and Its Application to Thermodynamics of Roasting of Nickel Sulfide Ores"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL-SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, 1982 pp 1-8

TEXT OF ENGLISH ABSTRACT: A computer method for constructing three-dimensional Kellogg diagrams is developed. By using a proper mathematic model, i.e., the equilibrium vector, predominance volume of each species is determined in such a way that the feasible set of a system of inequalities is arrived at in operation research. This makes the method simpler and more available. The use of extended BASIC language makes the procedure flexible. From the facts above, this method is especially suitable to the thermodynamic analysis of complicated more-variable systems. For example, the roasting of nickel sulfide ores is examined by generating the three-dimensional Kellogg diagrams for the four metal-sulfur-oxygen systems of nickel, copper, cobalt and iron, and by studying the position of predominance volumes of these systems in a bar-shaped region called Roaster Gas Composition Confined Bar and the effect of ferrite formation on roasting. The result is visual and consistent with industrial practices. Applications may be found in hydrometallurgy and in other fields.

AUTHOR: ZHONG Renbao [5907 0088 0202]

ORG: Department of Automation

TITLE: "On the Key Factors of Design and Implementation of Language System for Computer Algebra"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL-SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, 1982 pp 31-36

TEXT OF ENGLISH ABSTRACT: In this paper, first the design destination of language systems for computer algebra is determined. Second, based on the destination, the key factors of design and implementation of language systems for computer algebra are discussed according to the points of view of the design of system function and implementation. The problems to be solved are posed, and then the approach for solving them is given. Here the differences between the language system for computer algebra and that for numerical computing are emphasized.

9717
CSO: 4009/359

AUTHOR: ZHENG Qijing [6774 0366 4842]
CHEN Deying [7115 1795 5391]
ZHUANG Qingde [5445 1987 1795]
et al.

ORG: All of Nanjing Institute of Technology

TITLE: "Nucleation and Early Stage Growth of Polycrystalline Silicon Deposition"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 pp 91-104

TEXT OF ENGLISH ABSTRACT: The process of nucleation and structure of polycrystalline silicon film deposited on various substrates at 1050°C in a silane-hydrogen system are investigated. It has been found that both the nucleation behavior and structural features of the layer deposited in the early stage depend on the nature of substrates. In comparison with that on substrates of silicon oxide, the deposition on silicon nitride layer which covers the oxide surface results in earlier nucleation, smaller size and higher density of nucleus islands and finer grains. Reactions of silicon oxide with hydrogen and silicon deposited on it play an important role in the nucleation and growth of polycrystalline silicon on oxide substrates, and produce results different from those on the inert nitride substrates. The phase change in the condensed nuclei is also discussed.

AUTHOR: ZHUANG Qingde [5445 1987 1795]
ZHENG Qijing [6774 0366 4842]
CHEN Deying [7115 1795 5391]
et al.

ORG: All of the Nanjing Institute of Technology

TITLE: "Fringe Effect During EPI/Polysilicon Codeposition and a Model of Two-Dimensional Diffusion in the Stagnant Layer"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 pp 105-114

TEXT OF ENGLISH ABSTRACT: Experiments were carried out in which monocrystalline and polycrystalline silicon were simultaneously deposited on Si substrates selectively covered with SiO_2 or Si_3N_4 film. The fringe effect of abnormal nucleation on a narrow area of SiO_2 near the SiO_2/Si boundary is observed in a wide range of experimental conditions for SiO_2/Si substrates, but it does not take place on Si_3N_4/Si substrates. In this paper the fringe effect is explained by a horizontal diffusional flow, and a semiquantitative estimation is made by means of a two-dimensional diffusion model in the stagnant layer.

9717
CSO: 4009/353

AUTHOR: CAI Deli [5591 1795 4409]

ORG: Department of Electrical Engineering, Chongqing University

TITLE: "A New Computer Method for Fault Location on HV Transmission Lines"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 2, 1982 pp 1-18

TEXT OF ENGLISH ABSTRACT: This paper proposes a new computer method/impedance measuring method which is modified by the phase of fault current components. Under two-source line conditions, the new method can completely eliminate errors which usually exist in general impedance or reactance measuring methods due to the load currents and fault resistances, and also can determine the distance from the measuring terminal to the fault point with a high order of accuracy by using only current and voltage information at the measuring terminal of the transmission line.

The new method can also develop into a new algorithm of computer distance protection with superior properties to avoid the influences of load currents and fault resistance.

The high degree of accuracy of the new method has been verified by results which were obtained from tests using the CK-710 mini-control computer and the Apple II

[Continuation of CHONGQING DAXUE XUEBAO No 2, 1982 pp 1-18]

microcomputer to simulate different types of faults with various load currents, fault resistances and distances of fault points. The tests have been performed on the models of two HV power transmission lines: one is 220 KV, 243 KM long and the other is 130 KV, 47.3 KM long.

AUTHOR: DENG Xianli [6772 0341 4409]

ORG: Applied Mathematics Teaching and Research Group, Chongqing University

TITLE: "On the Effect of Time Lag Upon the Economical Operation of Cascade Hydroelectric Power Stations"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 2, 1982 pp 91-102

TEXT OF ENGLISH ABSTRACT: In this paper we discretize the state parameter--flow of cascade hydroelectric power stations--into the step function of time variable, and use constrained nonlinear programming to establish a mathematical model of economical operation which is universally applicable for general cascade hydroelectric power stations, and then we discuss the primary factors which affect the value of the time lag. According to each case of different values of the time lag, we have derived the formulas for calculating the gradient of augmented objective functions and other important formulas which will be used in SUMT for optimization. Furthermore, we derive the functional relation between the time lag and the state of operation of cascade hydroelectric power stations. We have researched the situations in which the time lag will cause the mutual relation between hydroelectric power stations to change. Finally, we reveal the law that the time lag will affect the economical operation of cascade hydroelectric power stations.

9717
CSO: 4009/355

AUTHOR: FANG Jian [2455 1696]
YU Bin [0060 1755]

ORG: FANG of the Beijing Institute of Aeronautics and Astronautics; YU of the Dong An Machine Works, Harbin

TITLE: "Investigation of Surface Grain Refinement of Superalloy Castings"

SOURCE: Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 3, 1982 pp 255-263

TEXT OF ENGLISH ABSTRACT: The mechanism of the surface grain refinement for superalloy castings has been investigated by examination of some recent allied approaches and by observations on the investment molds of various effectiveness using X-ray diffraction, microscopy and EPMA. It was identified that the grain refinement of the castings is dependent upon the decomposition of cobalt aluminate and the active alloying elements contained in the alloy. After the alloy was cast, the isolated particles of high temperature type cobalt were found on the surfaces of the investment mold and the castings, as well as the products of the mixture of cobalt aluminate together with different active elements heated under a vacuum. Both the vacuum DTA of cobalt aluminate mixed with Al powder and the thermodynamical estimation of the reaction may confirm that the formation of Co particles did not accompany an endothermic peak as was formerly suspected, but, in fact,

[Continuation of JINSHU XUEBAO No 3, 1982 pp 255-263]

a small exothermic effect was observed. It seems that the surface grain refinement of the castings is mainly due to the nucleation of the cobalt particles produced during casting. Thus, a rationalized process proposed has already been put into industrial practice with remarkable results.

AUTHOR: WANG Qimin [3769 0366 7036]
HE Guangxing [0149 1639 5281; deceased]
YE Rong [5509 2837]
et al.

ORG: All of the Shanghai Institute of Metallurgy, Chinese Academy of Sciences

TITLE: "A New High Strength Mg-Zn-Y-Zr Sheet Alloy"

SOURCE: Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 3, 1982 pp 309-310

TEXT OF ENGLISH ABSTRACT: A new high strength Mg sheet alloy, Mg-(3.0-3.8)percent Zn-(0.6-1.0) percent Y-(0.4-0.7) percent Zr, has been developed. The final heat treatment condition is the T_8 condition, namely, 515-520°C solution treated 1 hour, water quenched +15 percent cold work + 200°C 24 hours. Its room temperature tensile properties are shown as: σ_b = 33.5 - 34.0 or 29.0 - 30.0 kgf/mm^2; $\sigma_{0.2}$ = 30.0 - 30.5 or 19.5 - 20 kgf/mm^2; δ = 12-14 or 13.5 - 22.0 percent in longitudinal or transverse direction respectively. In addition, its tensile properties below 250°C are superior to those of both HM21XA-T_8 and AZ31B-H_{24}.

9717
CSO: 4009/351

Metrology

AUTHOR: WANG Juefei [3769 6030 7236]

ORG: Department of Science and Technology, Sichuan Provincial Bureau of Metrology

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 3, 18 May 82 p 63

ABSTRACT: With the assistance of Sichuan Provincial Research Institute of Metrological Tests and Experimentation and Chongqing Municipal Research Institute of Metrological Technology, the Peiling Prefecture Bureau of Metrology, Sichuan Province has succeeded in making the SJ-1 digital timepiece, which has been certified in Nov 81 by the Scientific Research Result Certification Conference, organized and called by the Sichuan Provincial Bureau of Metrology. With the photoelectric transducer, the digital timing instrument weighs 5.5 kg. Its stability is $\pm 1 \times 10^{-5}$ and the accuracy is $\pm 5 \times 10^{-5}$. Major technical specifications of the instrument are reported.

AUTHOR: WANG Juefei [3769 6030 7236]

ORG: Sichuan Provincial Bureau of Metrology

TITLE: "Successful Manufacture of the YB Type Extensometer Inspection Instrument"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 3, 18 May 82 p 64

ABSTRACT: In 1980, the National Bureau of Metrology assigned the task of studying on the making of an instrument to check and grade extensometers, an important instrument commonly used in testing the dynamic property of materials, to the Sichuan Provincial Zigong Municipal Bureau of Metrology. With the cooperation of Chongqing University, The 4th Region Stress Measurement Station of the Ministry of Machines No 5, and the Chongqing Special Steel Plant Research Institute, the Zigong Municipal Bureau of Metrology has completed the assignment after 2 years of hard work. The prototype has been through a large quantity of tests and repeated industrial experimentations before it was sent to production and research units for test application to prove it to be of good quality. Toward the end of 1981, a conference certified it. The successful manufacture of this instrument fills a blank in China and is definitely a contribution to the 4-modernization construction.

6168
CSO: 4009/341

AUTHOR: CHEN Lingfu [7115 0407 1318]
ZHOU Li [0719 4539]
YIN Daole [1438 6670 2867]
RUAN Jinghui [7086 2529 6540]
CHEN Guiying [7115 2710 5391]
CHENG Zhixu [2052 0037 4872]

ORG: CHEN Lingfu and ZHOU both of the General Research Institute for Nonferrous Metals, Ministry of Metallurgical Industry; YIN of the Department of Physics, Beijing University; RUAN, CHEN Guiying and CHENG all of the Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "A Study of Superconducting in C15 $(Hf_{0.5-x}Ta_xZr_{0.5})V_2H_y$ System"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 2, 1982 pp 93-102

TEXT OF ENGLISH ABSTRACT: A study of superconducting of C15 $(Hf_{0.5-x}Ta_xZr_{0.5})V_2H_y$ system reveals that both the relationship between T_c and y and the mechanism of the effect of hydrogen on T_c in this system are different from those in the Pd-H system. The results of thermal neutron inelastic scattering show that acoustic phonons are important for the variation of T_c. An evaluation of the distribution of hydrogen atoms in small and large concentrations in different interstices has been made on the basis of the theory of Jacob and Miedema. It seems that superconducting T_c rises when hydrogen atoms occupy mostly the 2Zr-2V interstices. A possible explanation of this effect has been proposed.

AUTHOR: CAO Xiaowen [2580 2400 2429]

ORG: Institute of Plasma Physics, Chinese Academy of Sciences, Hefei

TITLE: "Optimum Design of Superconducting Magnets with High Homogeneity--Sixth-order Volume Minimized Coils"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 2, 1982 pp 161-168

TEXT OF ENGLISH ABSTRACT: There is the possibility of reducing the cost of superconducting materials in the magnet if full use is made of the current carrying potentials of the middle and outer parts of the winding in the design of superconducting magnets with high homogeneity. It is proposed in this paper that the magnet consisting of two coaxial sixth-order coils with different current density will effect a considerable reduction in the cost of superconducting materials in the magnet if the ratio of the contribution to the central field of the inner and outer coils is properly selected. It is shown that in case of optimum design the cost of superconducting materials decreases by 40 percent when $R = C_2/C_1 = 1$, where C_2 and C_1 are the costs of unit volume of the outer and inner superconducting winding respectively; by 62 percent when $R = 1/2$; and by 66 percent when $R = 1/3$.

9717
CSO: 4009/350

Railroad Technology

AUTHOR: FAN Liexing [5400 3525 2502]
GU Xuezeng [7357 1331 1073]
ZHANG Zhenxin [1728 2182 9515]

ORG: All of Ziyang Internal Combustion Locomotive Plant

TITLE: "On the Future of Dongfanghong-4 Internal Combustion Locomotive"

SOURCE: Dalian NEIRAN JICHE [DIESEL LOCOMOTIVE] in Chinese No 5, 15 May 82 pp16-18, 26

ABSTRACT: From the 1st of May to the end of 81, the Dongfanghong-4 locomotives, No 0004, 0003, and 0002, produced by Ziyang Plant, had accumulated 27,418 km on the Zunyi to Guiyang Line. When this diesel engine was tested in Aug 81, it was confirmed that it can operate on lines of a grade limit of 20 percent and on less fuel than comparable Dongfeng-4 locomotives on the same lines. On its maiden trip, the governor on the 0002 broke down; 10 days later the nozzle of the antechamber broke off. After repairs had taken half a month, it operated for 20 thousand miles before cracks were discovered on 8 pistons. This time it took 9 months before the locomotive was back on the line but soon after it left Fengtai, the governor broke down again. In the No 4, 80 issue of this journal, seeking to be fair toward the Dongfanghong-4, ahpaper stated that in foreign countries, a locomotive usually takes 3-4 years before all its aspects are perfected; ometimes, even 8-10 years. The ND_4 diesel of France experienced many problems during its first 120 thousand km operation.

[continuation of NEIRAN JICHE No 5, 1982 pp 16-18, 26]

If such had been the case with a new product in China, perhaps some would suggest "shoot and kill them." The authors present arguments in the paper saying that the Dongfeng-4 took 7 years to complete and it was in reality an imitation product; therefore, a domestic design locomotive such as Dongfanghong-4 should certainly be given the opportunity and time it needs to improve its quality. The authors believe in spite of the problems and some antagonistic criticisms, the locomotive still should have a viable future, i.e. it should not be scrapped.

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CSO: 4009/338

END

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APPLIED SCIENCES

EXCHANGE CONFERENCE ON GROUP TECHNOLOGY DISCUSSED

Beijing JICHUANG [MACHINERY] in Chinese No 3, 1982 p 48

[Article by Li Peiyu [2621 3099 6877] of the General Design Institute of the First Ministry of Machine Building: "Some Views on the First Academic Exchange Conference on Group Technology"]

[Text] The Production Systems Science Group of the National Machine Processing Society held our nation's first academic exchange conference on group technology on 11 December 1981 at Xiamen. This exchange conference reflected the new developments in the past 2 years in our nation's group technology and the big improvement over 2 years ago. This also shows that our nation's group technology has passed the stage of propaganda and introduction and has entered the stage of conducting research at test points and gaining preliminary experience. The academic papers and technical information exchanged at this conference totaled 67 papers. The contents included several major aspects of group technology from software to hardware.

In product design: The test factories of the First Ministry of Machine Building, the Third Shenyang Machine Tool Plant, the Beijing People's Machinery Plant and the Beijing Hoisting Machinery Plant all compiled volumes of designs of spare parts and preliminary achievements were realized in product design. The next step is to complete the compilation of non-rotary parts following the volume on rotary parts already completed. This will establish a foundation for plans for computer-aided design.

In technology: Besides introducing the methods of compiling the technological flow in group technology and technological documents, the important papers were on grouping and classification of spare parts. For example, the characteristics matrix method of coding classifications of spare parts used by the Shenyang Third Machine Tools Plant and the People's Machinery Plant will help establish a computer data bank for classification of spare parts in our nation in the future. The grouping and matching of unit groups by the Beijing Aviation Academy, the study of the classification system for group technology of spare parts of textile machinery by the Qinghua University, the method of analysis of the production flow of the Shanghai Electrical Machinery Design Academy all proposed definite views on the use of different methods to solve the problem of grouping spare parts. Their proposals all have a definite standard.

In production management: The test factories of the Shenyang Third Machine Tool Plant and the Beijing People's Machinery Plant introduced concrete methods and experience in production management. "The problem of m x n ordering and the arrangement of the operating plans in group technology" published by Qinghua University and the "studies to determine batches in group technology" published by the Changchun Water Pump Plant have provided a theoretical basis for more rational application of group technology.

In computer-aided group technology: The "computer-aided program and system design for group technolgoy" by the First Design Institute of the First Ministry of Machine Building, and "preliminary application of microcomputers in data processing in group technology" by the Second Design Institute of the Ministry of Farm Machinery explored the use of the computer (especially microprocessors) in group technology which could provide various means of data processing by computers in factories and many plans for comparison. They have a broad adaptability and practical value.

In hardware design and research: The "design and application of group fixtures and group dies" of the 116 Plant of the Third Ministry of Machine Building, "design of machine tools for group processing" of the Second Automobile Manufacturing Plant, "group technology and adjustment fixtures" of the Nanjing Machinery Research Institute, "group processing machine tools and standardization of group fixtures" of the Shanghai Electrical Machinery Design Institute all have their value, and their standards are not low.

Participants included 15 provinces and cities and 10 ministries and bureaus. In most of these provinces, cities, ministries and bureaus, the machinery bureau and the science and technology department (bureau) organized test points in their own provinces, cities, ministries and bureaus. For example, the test factory of the First Ministry of Machine Building and the Beijing People's Machinery Plant cooperated with the Designing Department of the General Designing Institute of the First Ministry of Machine Building. They conducted four separate overall tests at the third subsidiary plant and they obtained welcomed results. This year, they will complete readjustment of all rotary parts, and non-rotary parts will be readjusted in 1983. Studies have been carried out in product design, production management and the application of microprocessors. It is planned that by 1983, improvements in group technology at the plant will be completed. The Second Jinan Machine Tool Plant has cooperated with the Sixth Designing Institute of the First Ministry of Machine Building of the Hefei Industrial University. They plan to complete work at the test point by 1983. Hubei Province has established test points at the First Machine Tool Plant in Changsha City, Beijing City has established a test point at the First Machine Tool Plant, and Guangzhou Cith has established a test point at the Guangzhou Machine Tool Plant. In addition, the Third Ministry of Machine Building, the Fourth Ministry of Machine Building, the Coal Ministry, the Farm Machinery Ministry and Shanghai City and Sichuan Province also have their own test points units.

Although many factories are not test factories, they also have taken the initiative to study and utilize group technology. The above situation shows that group technology is already being gradually recognized and emphasized by

all. Everyone has recognized that group technology is the necessary road of technical improvement in enterprises engaged in medium and small batch production. To change the backward situation in production by enterprises engaged in medium and small batch production of many varieties of products in our nation's machinery profession, we must utilize group technology. Group technology is emphasized by everyone because it not only can expand batch production and thus utilize more advanced technologies, reduce the percentage of waste products, improve product quality, shorten the production cycle, reduce accumulation of products in production and floating capital, shorten transportation routes of spare parts, reduce transportation cost, realize the best material flow, reduce product cost, improve productivity rate, it can also be used in the design of products after a classification and coding system for spare parts has been implemented, so that product design can realize the best three izations. This can greatly reduce the amount of work involved in preparing design blueprints (generally this can be reduced by 50 to 75 percent) so that product design can be hastened, and the rate of renovating products and the competitive ability of products can be improved. At the same time, a foundation for the utilization of computer management can be established in production management. Group technology is an aspect of systems engineering that includes product design, technology and production management. It is a science that penetrates deeply into all departments of the enterprises and that realizes overall technical improvement of the enterprises. Group technology, technically speaking, has far surpassed the scope of machinery processing. In the world, it has already been applied in casting, forging, welding, punching, heat treatment and assembly. Group technology is the foundation of CAM, CAD, FMS and CAPP. The study of material flow of enterprises engaged in medium and small batch production cannot be separated from group technology.

At present, our nation's group technology is in a stage of having group technology without using codes, while the Soviet Union began using codes at the beginning of the 1950's. When using a classification and coding system for spare parts, because of the lack of a classification software package (the characteristic matrix of classification), there is a definite difficulty in classifying spare parts, therefore many factories use the method of classification without coding. To realize a definite gain in technology and production, this method is acceptable during the transition stage. To enable the whole factory to realize overall gains and to use group technology in technology, in product design, in production management and in computer-aided operations, we must use a classification and coding system for spare parts. Therefore, our nation's promotion of group technology should surpass the stage of group technology without coding and should advance towards the goal of a coding system. We should utilize the period of readjustment to design a coding system and at the same time carry out related software research and design, make technical preparations well and make preparations for popularization and for providing consultation in group technology in our nation in the future. In addition, the application of microprocessors in group technology should be included as a key point. This is because when using a coding system, the compilation of statistics and computation of massive amounts of data, especially in production management, will not be possible without a computer. The microprocessor is

economical, and it is easy for medium and small enterprises to acquire. According to the present situation, group technology in our nation is still in a testing and research stage. Only by summarizing the overall experience can its popularization be facilitated. At present, technical preparations should be done well to provide good council for the use of group technology by more enterprises in the future.

9296
CSO: 4008/151

TUMOR INSTITUTE PUBLISHES CANCER STATISTICS

Shanghai JIEFANG RIBAO in Chinese 13 Apr 82 p 1

[Article by Wang Minmin (3769 2404 2404): "Statistics of the Municipal Tumor Institute Indicate Different Findings Depending on Whether or Not Tumor Prevention Has Been Instituted -- The Incidence of Cancer of the Cervix Has Decreased by Half Whereas the Incidence of Lung Cancer Among Men Has Risen Eighty Percent"]

[Text] The case statistics published most recently by the Shanghai Municipal Tumor Institute on registered reports of malignant tumors for the city as a whole over the past fifteen years indicate that there has been a decrease of close to 60 percent in the incidence of cancer of the cervix, with a decrease in the mortality rate of 52 percent, whereas there has been an increase in the incidence of lung cancer among men of 80 percent. Tumor specialists stress that these contradictory data are a full indication of the fact that prevention and lack of prevention have different consequences and that it is to be hoped that vigorous preventive measures will be taken against the principal known cause of lung cancer -- cigarette smoking.

Because there are fixed fluctuations in the incidences of malignant tumors from year to year, it is only by means of data accumulated over long periods that it is possible to obtain a true reflection of the state of occurrence of various types of malignant tumors. Under the unified leadership of the Municipal Public Health Bureau, this city has since 1963 operated a system of registering and reporting new cases of and cases of deaths due to malignant tumors through the medical facilities and sanitation and antiepidemic stations at the district level and above throughout the entire city. To date, the Shanghai Municipal Tumor Institute has gathered and accumulated data on occurrences of tumors and deaths over the past 20 years.

The epidemiological data on tumors that have been provided by the Tumor Registration and Reporting Office of this city have come to be regarded with the respect and interest of the World Health Organization. Internationally, there is published each year a collection of data entitled "Incidences of Malignant Tumors in Five Continents." The fourth volume, which was published this year, includes our data on occurrences in Shanghai City.

10019
CSO: 4008/167

NEW DISCOVERIES IN CHROMOSOME DAMAGE IN NEWBORNS REPORTED

Beijing JIANKANG BAO in Chinese 22 Apr 82 p 1

[Article by Liu Xiaochung (0491 4562 2504): "Department of Medicine and Genetics of Hunan Medical College Makes New Discoveries in Survey of Chromosome Damage in Newborns"]

[Text] Most recently, the Department of Medicine and Genetics of Hunan Medical College conducted a survey of chromosome damage in more than 3000 newborns and published their initial results.

In order to investigate the distribution and laws of occurrence of chromosome damage among the masses, the Department of Medicine and Genetics of Hunan Medical College has since May 1979 performed analyses of the umbilical cord blood of more than 3000 newborns born at the Sanjia Hospital in the northern district of Changsha City using the type G umbilical cord chromosome display technique. Of 2079 specimens that have been analyzed, 15 cases of chromosome abnormality have been discovered. Twelve types of chromosome abnormality involving 13 cases were discovered for the first time in this country. There were 6 cases that were the first reports of their kind in the world.

In the course of the survey, the research workers conducted studies and analyses of the causes that produced the chromosome abnormalities in the newborns. They discovered that there were evident familial genetic histories and that there were new mutations closely related to the work in which the parents were engaged. This research has provided the most direct and most basic survey materials relating to environmental protection, prevention of chromosome damage and family planning in our country and has made a new contribution to studies of the incidence of chromosome abnormalities among the masses of China.

10019
CSO: 4008/167

BURN AND PLASTIC SURGERY CONFERENCE HELD IN SHANGHAI

Beijing GUANGMING RIBAO in Chinese 7 Jun 82 p 1

[Article: "A New Treatment for Burn Victims"]

[Text] Material provided by the All China First Burn and Plastics Conference has shown that this year China has made a new breakthrough in treating victims who have special localized burns on the head, hands, esophagus and respiratory tract.

China has been in the leading ranks of the world for more than 20 years in the treatment of large area burns. With the continuous rise in success in saving burn victims over the last several years many Chinese hospitals have carried out thorough research on the problem of how to improve and restore life and work capabilities to sufferers. Along with saving the victims, plastic surgery was also done so that many severely burned victims could gradually take care of themselves and begin work again after leaving the hospital.

The transplanting of the greater omentum and skin-grafting of the skull for serious electrical burns was successfully developed and used by the Burn Department of the Jishuitan Hospital in Beijing and the Trauma Orthopedics Research Institute in Beijing. In the past, this type of burn victim had to have the necrotic skull removed which caused a great deal of pain. At the end of 1979, when they performed this surgery on a victim with serious electrical burns on the skull, they only removed a small amount of sclerite on the surface layer and left the lower layer of necrotic skull. Afterwards, the transplanted greater omentum covered the skull, the skin-graft repaired the wound surface and the surgery was completed. This victim recovered 11 days after surgery and in the more than 2 years since returning to work says that he feels fine.

Several hospitals in China have used forearm skin-grafting surgery to reconstruct facial burn deformation treatment results were excellent. According to statistics for the General Hospital of the Shenyang military area, in the past 2 years, this hospital has performed 59 cases of forearm skin-grafting recreating noses and eye sockets, joining the face and neck and repairing face and jaw atrophy. Among these, 56 cases were successful.

In the past, most vicitms with electrical burns resulting in necrosis in the blood vessels and nerves of the forearm would have the limb removed whether or

not the palm and fingers were intact. In the last several years, Beijing, Shanghai and People's Liberation Army hospitals have used microsurgery techniques for skin-grafting as early as possible when treating burn victims and also for rebuilding the forearm's blood circulation and nervous system. In this way, they avoid removing the hand. After the wound heals the use of the hand can be restored.

Recently, the Burn and Plastic Surgery Conference was convened by the China Medical Association in Shanghai. Over 300 scientific papers were exchanged at the conference. The papers included those by the No 3 Military Medical University of the People's Liberation Army on the manufacture and experimental research on heavy respiratory tract steam burns of animal models, and those by units of the Ruijin Hospital and No 9 People's Hospital of Shanghai on the preservation of xenogenic skin and heterogenic skin (piglet skin) and its application in treating burns as well as papers on the reconstruction of the penis and transplanting the small intestines to rebuild the esophagus. These papers were all original and of a high scientific level.

9480
CSO: 4008/185

RESEARCH ON ARTIFICIAL BLOOD NOTED

Shanghai JIEFANG RIBAO in Chinese 11 May 82 p 4

[Article by Liu Debao [2962 1795 1405]: "Extracting 'Blood' From Petroleum"]

[Text] Since the beginning of this century, petroleum has opened up a broad new field of organic synthesis. Yet, the ability to extract blood from petroleum is a marvel of modern science. China, Japan and the United States have conducted clinical experiments and to date over 300 patients have been brought back to life by infusions of this type of artificial blood.

Petroleum is a hydrocarbon; hydrogen and carbon make up 96 to 99 percent of petroleum. After hydrogen atoms and carbon atoms undergo chemical combination and decomposition they form a multitude of chemical compounds with other elements. In these compounds, under special conditions, carbon and hydrogen produce violent reactions with fluorine. After fluorine atoms "drive out" the hydrogen atoms in the compound, they combine with the hydrogen atoms in the compound to form a fluorocarbon compound and after entering an emulsifier, a milk type emulsion is formed called a fluorocarbon emulsion.

The rpoperties of carbon fluoride emulsion are stable and possess excellent oxygen dissolving abilities. In the human body, more than ten thousand red blood cells grow and die each second. To maintain this type of metabolism the body must rely on the hemoglobin in each red blood cell to send oxygen to the blood and excrete carbon dioxide from the blood. Whenever a large amount of blood is lost anemia or respiratory difficulties cause anoxia. Also, when the ability of the blood to send oxygen is weak, use of a carbon fluoride emulsion can cause the red blood cells in the human body to rapidly recover the ability to send oxygen. Its ability to carry oxygen is twice as great as that of hemoglobin and it only requires 14 to 16 milliseconds (1,000 milliseconds is equivalent to 1 second) to be able to completely dissolve and release oxygen. Hemoglobin, however, requires 90 milliseconds to complete this task. Because the diameters of its corpuscles are small its size is only one-hundredth that of a red blood cell. Therefore, it can very quickly reach the blood capillaries which do not allow red blood cells to pass through. This provides timely help for emergency treatment.

Because this type of artificial blood is a chemical product and is not a living substance it is easy to store. Human blood must be kept cold but carbofluorine chemical compounds do not require cold storage and thus can be preserved for many years. Moreover, it can disinfect and thus prevent hepatitis and other infectious diseases. It is not divided into blood types and so everyone can use carbofluorine artificial blood.

Based on experiments, when a rat is immersed in carbon fluoride solution it dies before it suffocates. Japanese scientists replaced 90 percent of a dog's blood with fluorocarbon emulsion and the dog remained in good health. Under emergency conditions, 50 Japanese patients used this blood substitute and the results were excellent. At present, the extraction of artificial blood from petroleum still requires continuous research as regards its nutritional material, maintenance of human body growth equilibrium, immunity and [coagulated (?)] blood so as to make it even better.

9480
CSO: 4008/185

PROVIDING SCIENTIFIC BASIS FOR PREVENTING DISEASE

Beijing JIANKANG BAO in Chinese 4 Apr 82 p 2

[Article by Huang Zemin (7806 3419 3046) and Du Shaoyong (2629 4801 7167): "For Two Years Our Nation's Epidemiology Workers Have Monitored Practice to Provide a Scientific Basis for Establishing and Modifying Disease Prevention"]

[Text] Over the past two years our nation established 30 urban and rural long-term disease monitoring points in 13 provinces and cities and have engaged primarily in monitory acute infectious diseases among more than 3 million persons, with more than 300 thousand samples of scientific data having been collected. This has been the first major systematic practical exercise on the part of our nation's epidemiology workers since the founding of the nation.

Monitoring of diseases involves observing trends in the distribution of diseases in one place and in several places and continually providing scientific data in order to establish and modify measures for preventing various diseases and the bases for their implementation. Although our nation's sanitation and epidemic prevention sectors have carried out some disease monitoring work in the past, this work has not been systematized or institutionalized. In addition, no scientific evaluations by means of monitoring were made of the epidemic prevention measures that were adopted, and, for this reason, forward-looking epidemiology research work has not been developed. In 1978, the Epidemiology and Microbiology Institutes of the Chinese Academy of Medical Sciences proposed a tentative plan for establishing long-term disease monitoring points. In 1979, they cooperated first with the Sanitation and Antiepidemic Station in the Dongcheng District of Beijing City in conducting tests, with long-term forward-looking observations being carried out in a district with a population of close to 100 thousand persons. After the firsthand data were obtained, the Epidemiology Institute cooperated with sanitation and antiepidemic stations in 13 provinces and cities in establishing 30 urban and rural long-term disease monitoring points. Observations were made of the circumstances of occurrence of 16 types of infectious diseases in a population of more than 3 million 60 thousand persons. A preliminary clarification was made of trends in the distribution of these diseases. At the same time, monitoring of information about epidemics and studies of failures to report occurrences of infectious diseases were carried out. Last year, observations were made at these monitoring points on close to 3 million 850 thousand persons, with data on the incidences of

17 types of acute infectious diseases being obtained. A survey was made of failures to report acute infectious diseases among 450 thousand persons, with ratios of failure to report infectious diseases in the cities and rural villages of the nation as high as 37.7% and 31.2% being discovered. This indicates that that the system of reporting acute infectious diseases in our urban and rural areas is in urgent need of strengthening. As the result of the survey of ratios of failure to report, the reported incidences at the monitoring points were corrected and we obtained estimated actual incidences of various types of acute infectious diseases. Last year, the monitoring points conducted a survey of paralytic sequelae of poliomyelitis among 3 million 510 thousand persons, finding a total incidence of sequelae of as much as 1.2%. It was found that 88.7% of the patients with sequelae had not taken poliomyelitis vaccine. In addition, the monitoring points also surveyed the status of preventive inoculations among 1 million 980 thousand persons and registration of reports of causes of death among 3 million 850 thousand persons. Determinations were also made of levels of immunity among the masses. The data obtained will be of great value in formulating measures for preventing and controlling infectious diseases.

Most recently, the Ministry of Public Health held an all-China disease monitoring conference at which work experiences were exchanged. The Vice-Minister of Public Health, Zhang Huangshu [1728 7806 2885], attended the conference and presented an address.

10019
CSO: 4008/167

AUTHOR: BAO Yucheng [0545 5940 2052]

ORG: None

TITLE: "The Board of Directors (Expanded) of Shanghai Municipal Society of Communications Convened"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 5, 20 May 82 p 27

ABSTRACT: The Shanghai Municipal Society of Communications called a Board of Directors meeting in the afternoon of the 19 Feb 82. It was chaired by the Chairman of the Board CHEN Xingyan [7115 2502 1484]. Winners of the papers submitted to the 1980 Annual Conference were announced and five of these were selected to participate in the essay competition of the Shanghai Municipal Science Association. The Vice Chairman of the Board, Prof ZHANG Xu [1728 3563] handed the award certificates and the bonus money to the authors of 16 papers. The Secretary of the Society, ZHAO Zhangming [6392 1757 2494] invited these authors and some liaison officers to a meeting to solicit their opinions concerning the work of the society for 1981 and future scientific activities. Photos were taken of the members of the First Board of Directors, authors of the winning papers, and those who participated in the scientific activities.

AUTHOR: HONG Hua [1347 5478]

ORG: None

TITLE: "CL Series Photoelectric Components Successfully Made in Suzhou"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 5, 20 May 82 p 41

ABSTRACT: In order to meet the needs of new generation digital meters, the Suzhou Semiconductor Main Plant, with the cooperation of Nanjing Telecommunication Instrument Plant, et al, has successfully made the CMOS-LED photoelectric component display device, the design of which has recently been certified. This type of photoelectric component is the first in China and will open up a new realm for digital display. Its advantages include low power consumption, bright, small, long lasting, and convenient to use. It will serve as the new device for the final stage digital display of electronic instruments, automatic control devices, and computers to provide a favorable condition for simplifying the circuit structure of the entire instrument, making it smaller, reducing the time required to make the instrument, and improving its reliability. The Certification Conference regarded this type of CMOS-LED photoelectric component to be the direction of development of the semiconductor photoelectric digital display technology and recommended its extension and application.

6248
CSO: 4009/349

AUTHOR: ZHU Xian [0504 6343]

ORG: None

TITLE: "The 495QA High Speed Light Weight Vehicle-Use Diesel Engine Completes Certification"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 2, 15 Jun 82 p 85

ABSTRACT: On 23-27 Mar 82, the Yunnan Provincial Department of Machinery called a New Products Provinical Level Certification Conference in Kunming to examine the 495QA diesel engine, produced jointly by the Yunnan Internal Combustion Engine Plant and the Shanghai Internal Combustion Engine Research Institute; 72 representatives of 40 management departments, scientific research units, schools of higher education, and production and operational departments participated. The maximum power of this engine is 72PS/3200rpm, with a maximum torque of 18kgf·m/2100rpm, an external size of 881 x 642 x 757 mm, a total weight of 310 kg, and a minimum fuel consumption rate of 187 g/PS·h. The representatives seriously examined the product diagrams, the technical data, the engine properties, the work procedure documentation and installations and concluded that the quality of the product is stable and the equipment of Yunnan Internal Combustion Engine Plant is satisfactory for producing it in batches. After close to 2 years of designing, experimenting, and test production, the engine has been proved to meet the requirement of light weight motor vehicles and other power machines.

AUTHOR: CHEN Hao [7115 3185]

ORG: None

TITLE: "The New 300 Series Medium Speed Diesel Engines Designed in China Has Been Made Suffessfully"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 2, 15 Jun 82 p 86

ABSTRACT: The certification conference for the new 300 series 6 and 8 cylinder diesel engines was held in Wuxi on 3-7 Apr 82. The conference was organized by the Ministry of Agricultural Machinery, the Ministry of Machines No 6, the Ministry of Transportation, the National Bureau of Standards, the National Bureau of Marine Products, etc. and 141 delegates representing 80 organizations attended. This series of diesel engines are products of joint research by Shanghai Research Institute of Boat-use Diesel Engines, Wuxi Diesel Engine Plant, Ningbo Power Machinery Plant, Changhang Science Research Center, Guangdong Fishing Boat Plant, etc. The research took 7 years and 9 months. The design indices of these engines are 1000 PS for the 6 cylinder engine, and 1350 PS for the 8 cylinder engine; the mean effective pressure is 14.15 kgf/cm^2; the fuel consumption rate is 160 g/PS.h. The number of cylinders may be added in the future and the rotation speed changed to raise the power to 5300 PS. The conference suggests that the lubricant consumption rate should be further reduced, the use of heavy diesel oil should be experimented further, and the reduction of noise and vibration and the utilization of residual heat should also be studied further to raise the quality of the products.

6248
CSO: 4009/348

AUTHOR: None

ORG: The Secretariat, Chinese Society of Mechanical Engineering Nondestructive Testing Society

TITLE: "The Second Annual and the First [Plenum] Expanded Conference of Directors of the Nondestructive Testing Society of Chinese Society of Mechanical Engineering was Held in Beijing"

SOURCE: Shanghai WUSUN JIANCE [NONDESTRUCTIVE TESTING] in Chinese No 3, Jun 82 p 46

ABSTRACT: The Second Annual Expanded Conference of Directors was held in Beijing on 3-4 Mar 82 and 45 members attended. There was first a brief report of the 30th Anniversary Meeting of the Society of Mechanical Engineering. The various specialty groups and committees discussed and formulated their activity plans for 1982 and 31 items of scientific exchange and activities were proposed for the years 1983-85. Following some negotiations, the composition and the persons in charge of these groups and committees were duly readjusted. The composition of the delegation to the 10th Annual International Conference of Nondestructive Testing was decided upon and sent to the Society of Mechanical Engineering for approval. For the purpose of guaranteeing the quality of industrial products, their safe transportation, and of meeting the requirements of foreign trade and foreign technical and economic cooperation, the problem of training and qualifying technicians of nondestructive testing should be given urgent attention. It was suggested at the conference that internationally accepted standards and examination procedures should be adopted.

6168
CSO: 4009/347

Metallurgy Technology

AUTHOR: None

ORG: The Steel Rolling Science Committee, Chinese Society of Metals

TITLE: "First Conference of Metal Products Technology"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese Vol 17 No 5, May 82 p 77

ABSTRACT: The First Conference of Metal Products Technology of the Steel Rolling Science Committee of Chinese Society of Metals was held in Hangzhou 1-6 Dec 81. After more than one year of preparation, the conference received 35 papers and 11 of them were read at the meetings. The delegates believed that it is important to speed up the modernization process of steel and iron technologies and were especially interested in the direction of development of steel wires and related products. The conference recommended 9 papers on the subject. Discussions centered upon improving the quality of products, expanding the varieties of products, reducing the energy consumption and the cost of production, satisfying the needs of various departments of the national economy for development and for entering the international market. The following were believed to be essential: (1) Wire rolling machines should be built and reconstructed to enable them to produce wires of ϕ 5.5mm and weighing above 500kg/tray; (2) oxidation-free and microoxidation heat treatment should be developed; (3) Lubricating and cooling conditions should be improved to lengthen the life of molds; (4) The product structure of steel wire cable should be changed; (5) Research on plated steel wires should be strengthened; (6) The blank of alloy steel wires should be filled; (7) Advanced testing instrument should be provided. (8) More market research; (9) Establishing specialized research units.

AUTHOR: TANG Zuwen [0781 4958 2429]

ORG: None

TITLE: "National Superconduction Technology Discussion Meeting"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese Vol 17 No 5, May 82 pp 77-78

ABSTRACT: The National Symposium on Superconduction, jointly organized by the Chinese Society of Metals, the Chinese Society of Physics, and the Chinese Refrigeration Society, was held in Beijing 11-15 Dec 81. Participants included 150 delegates of more than 90 organizations, and 117 papers were received. The delegates were divided into 4 groups of superconductive materials, magnets and their application, weak charge devices, and refrigeration technology for the purpose of discussion. There have been extensive research studies in all the 4 technologies and good results have been obtained, but the development is by no means balanced. Regarding superconductive materials, foreign standards have been basically reached and such materials as NbTi, Nb_3Sn, and V_3Ga have been studied since the early 70's and at present all are being produced in small batches. Regarding aspects of application, superconduction has been commercialized in foreign countries; and China is still a great distance behind and more work is needed. The first small nitrogen liquefaction installation in China has been produced by the Research Institute of Physics Chinese Academy of Sciences in the 50's and currently there are 40 such installations in the country. Proposals of studying magnetic selecting machine and application of superconductinn in weak charge aspects were considered at the symposium.

AUTHOR: CHEN Luyin [7115 4845 5419]

ORG: None

TITLE: "The Second Annual Technological Economics Conference Held in Wuhan"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese Vol 17 No 5, May 82 pp 78,46

ABSTRACT: The Metallurgical Technological Economics Committee of Chinese Society of Metals held its second annual conference in Wuhan 28 Dec 81 - 2 Jan 82 and 125 delegates participated. The conference received 13 papers; 12 of these on "Management of Engineering Items in Industrial Management," "Preliminary Method of Market Research and the Research on Steel and Iron Markets in China," "A Strategy for the Full Development of 1.7 m Rolled Steel," "Strengthening Industrial Management to Improve the Economic Benefits of Jiangxi Tungsten Mine," etc. were recommended by the conference as superior papers. The comrades of the Mining Group proposed that problems of laws regulating mine workers, the wage policy, and the price policy should be studied in the future. The Colored Metal Group suggested that the development of a lead industry should be given preference in China. All participants felt that in view of the fact that the work of technological economics is being emphasized by both the central and the local jurisdictions, the team of specialists of technological economics cannot catch up with the development of the metallurgical industry in China; therefore, the committee should emphasize the training work of this field.

6168

CSO: 4009/346

Prospecting Engineering

AUTHOR: FENG Sheng [7364 3932]

ORG: None

TITLE: "Excerpts of Papers of the First Technological Conference of Pit Prespecting' Engineering"

SOURCE: Beijing TANKUANG GONGCHENG [PROSPECTING ENGINEERING] in Chinese No 3, 20 Jun 82 pp 3-7

ABSTRACT: The First Technological Conference of Pit Prospecting of the Committee of Prospecting Engineering Specialty of Chinese Geological Society was held in Wuhan on 11 Nov 81; 162 delegates representing departments of metallurgy, construction materials, electric power, railways, transportation, and geology of 24 provinces attended. The conference received 85 papers; 82 of these were accepted and 45 read at the meetings. In the past 32 years, a total of 8 million meters of tunnels, 8 million m of shallow wells, and 179 million m^3 of deep trenches were dug and 1.2 million m were advanced with sample-taking drills for prospecting. The papers presented to this conference represent the crystallization of the experience and scientific research studies of China's scientists, educators, and workers of this field. Short excerpts of these papers are collected in the paper.

AUTHOR: HAN Junzhi [7281 6511 2535]

ORG: None

TITLE: "Excerpts of Papers of the Special Subject Symposium of Percussion Rotary Drilling"

SOURCE: Beijing TANKUANG GONGCHENG [PROSPECTING ENGINEERING] in Chinese No 3, 20 Jun 82 pp 27-31

ABSTRACT: The Chinese Geological Society Prospecting Engineering Specialty Committee called a Percussion Rotary Drilling Symposium in Changsha of Hunan Province 28 Oct to 1 Nov 81 and 98 delegates attended. The symposium received 28 papers and 23 of these were delivered at the meetings. Contents of the paper included hydraulic percussion bit design, improvement, and theoretical computation, properties and condition of experiment of various types of percussion devices, selection of drill parameters and operation formulas, improvement of the quality of abradant and increasing the types of drill bits, research studies on related equipment, accessories, tools, instruments, and meters, and new subjects in hydraulic percussion drilling in need of further study and development. Research and application of hydraulic percussion drilling have been carried out in China by 57 scientific research, schools of higher education, and production organizations and a total of 120 thousand m of drilling has been accumulated. The depth of the largest hole was 605 m and the most efficient drill had an efficiency of 1457.6 m/month. Short excerpts of the papers are given.

6168
CSO: 4009/352

END

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SCIENCE AND TECHNOLOGY

No. 169

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APPLIED SCIENCES

GUANGZHOU AREA MAKES PROGRESS IN PROMOTING LASER TECHNOLOGY

Guangzhou GUANGZHOU RIBAO in Chinese 6 Jun 82 p 2

[Article: "Applying Lasers in Industrial and Agricultural Production and in Medical Treatment, Guangzhou Area Makes Progress in Promoting Laser Technology"]

[Text] In recent years, Guangzhou area has selectively applied laser technology in industrial and agricultural production and in medical treatment with visible results. At present, the work of applying lasers in the Guangzhou area is being popularized among the basic levels. Research in the mechanism of lasers is deepening, and it is developing towards improvement of the quality of components and devices.

The application of laser technology began relatively early in the Guangzhou area. At Zhongshan University, one of our nation's bases of research in spectroscopy, spectroscopy specialist Professor Gao Zhaolan [7559 0340 5695] guided a research team in the Guangzhou area and it developed an active function. The City's science committee emphasized research in the application of lasers and grasped the establishment of a laser science and technology team. A group of scientific and technical workers who are young and energetic, who are deeply involved in research and who are enthusiastic about popularizing laser technology has emerged. In January of this year, the Guangzhou Laser Society was founded and academic exchange are more active than before.

In recent years, laser medical science has become popular in clinics. According to incomplete statistics, lasers have been used to treat 700,000 person-times throughout the area. The helium-neon laser has been widely used to treat inflammatory diseases with visible results. Some medical units have further combined laser treatment with other treatments and have greatly improved the effect of treatment. Laser is more commonly applied in surgery, dermatology, treatment of tumors, ophthalmology, otolarnygology, gynaecology, and obstetrics. The tumor hospital subsidiary to the Zhongshan Medical College used two methods to treat tumors with lasers. One method was excision using a carbon dioxide laser and the other was evaporation and irradiation by laser. Clinical analysis and comparison showed that the two methods above could rapidly and accurately remove focus and there was little or no bleeding during the operation. The method of using lasers to treat

superficial benign tumors and pre-cancerous pathological changes is simple and better than ordinary surgery, and the results are visible. The opthalmological hospital explored the use of the helium-neon laser to irradiate and treat keratitis of surface spots and realized satisfactory results. The Second People's Hospital in Guangzhou used lasers to treat the cervical vertebra syndrome. The method was simple, the patients did not suffer any pain and the results of treatment were good. The hospital also used the principles of acupuncture anesthesia. It used a low power helium-neon laser to irradiate acupuncture points for anesthesia. Clinical tests showed that laser anesthesia and acupuncture anesthesia produced basically the same results, but laser treatment also stimulated the growth of granulation and hastened the healing of the wound, killed pain and disinfected. The otolaryngological department of the First People's Hospital of the City used optical fiber conducted laser beams to penetrate the narrow and deep cavities of the ear, nose and throat and accurately irradiated focus or acupuncture points. Ideal results of treatment were realized. The percentage of recovery from false cysts of the auricle using laser treatment reached 85.6 percent. The period of recovery was fast and the patients felt that the treatment was convenient.

Concerned units carried out research in the use of lasers in industrial and agricultural production and solved some difficult problems in production. The Guangzhou Electro-mechanics Research Institute developed a cable diameter measuring and controlling device. It can quickly and accurately perform measurements and automatically control the outer diameter of electrical cables. It has provided an advanced technological equipment for automatic and high speed production of electrical cables, reduced the labor intensity of workers, conserved raw materials, and improved the quality of products. Each research unit has successfully developed the laser collimator for use in civil engineering, ore selection and construction measurements for laying pipes in river beds. The Huanan Engineering College researched a laser holographic information storage device which showed a promising future. The three-way laser collimator of the Wenchong Shipyard can connect the spatial relationships of dots, lines and planes of many directions for use in building, installation and construction of ships and large machinery. It is accurate and convenient. The agricultural science department is also popularizing the cultivation of plants using lasers, and definite achievements have been made.

On the basis of broad application, the scientific and technical workers in the Guangzhou area are carrying out further in depth studies of the theory of lasers. At the academic reporting conference on laser held recently in Guangzhou, a number of reports on achievements in basic theoretical research attracted the attention of academic circles. The "study of multiple exposure streaks and their use in measuring velocity" by teacher Zheng Shunxuan [6774 7311 2467] el al of the Physics Department of Zhongshan University tested the use of a helium-neon laser of low output power to photograph multiple exposure streaks and obtained good quality photos of streaks. The device can continuously photograph creeping speeds and the strain of objects under force. This research has passed the evaluation and review by the Sixth National Laser Conference. The "effects of tube length

and tube diameter in stimulated Raman scattering" and "the use of serially stimulated Raman effect to expand the wavelength of lasers" researched by that department have also made discoveries and presented unique opinions. Preliminary exploration of the theory of laser protection has been conducted by the Guangzhou Medical Academy, the City's Second People's Hospital, the City's epidemic prevention station and the provincial industrial diseases prevention and control hospital. They have individually or jointly conducted analysis of the chromosomes of laser workers, eye examinations and made physical examination reports. These efforts have an active significance in doing protective work well and in further popularizing the application of laser technology.

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POWER ENGINEERING INSTITUTION MEETS IN SHANGHAI

Shanghai DONGLI GONGCHENG [POWER ENGINEERING] in Chinese No 2, 1982

[Article: "Report on the Shanghai Meeting of the Power Engineering Institution of the Chinese Mechanical Society"]

[Text] The power Engineering Institution of the Chinese Mechanical Society held a meeting in Shanghai from February 24-27 of 1982. They discussed arrangements for academic activities in 1982 and preliminary ideas on institution work for the 1983-1985 period. Also discussed were matters related to preparing for holding the fourth annual meeting as well as editing and publishing work and organizational construction. Present at the meeting were 47 standing directors, directors and various special committee core members. The Chinese Mechanical Society also sent personnel to participate in the meeting. The meeting was chaired by Director Wang Xinmin [3769 2450 3046]. Secretary-General Yang Jinshu [2799 6930 1472] reported on the general situation of institution work for 1981, preliminary ideas on institution work for the 1983-1985 period as well as views on convening the fourth annual meeting of the Power Engineering Institution. Chen Xuejun [7115 1331 0193], Wang Dingguo [5502 1353 0948], Yao Fusheng [1202 4395 3932] and Qiu Changqing [6726 7022 3237] presented the general aspects and their personal understanding of the scientific and technological advancements of power engineering abroad.

The meeting basically reached a consensus on the following matters.

1. Arrangements For Institution Activities in 1982

Plans for institution activities in 1982 were discussed at the meeting and each specialized committee was to actively make preparations. Further, based on a proposal by the turbine specialists, a symposium was added on the technical problems of air coolers. At the same time, the "Academic Symposium on the Key Technical Problems of Large Scale Steam Turbines" originally set to be held in 1982 was changed to the "Academic Symposium on the Problems of Strong Vibrations in Large Scale Steam Turbines." The actual contents will be arranged at the annual meeting.

2. Preliminary Ideas on Institution Work During the 1983-1985 Period

After discussions at the meeting, it was proposed that the "preliminary ideas for the Power Engineering Institution in the 1983-1985 period be

revised and supplemented and that preliminary arrangements be made on the academic activities of the various specialized committees for the next few years.

3. Preparations For Holding the Fourth Annual Meeting

The council seriously considered the "views on holding the fourth annual meeting of the Power Engineering Institution." They also revised and supplemented the central topics for discussion, arrangements for the main contents as well as the method for collecting and appraising papers at the fourth annual meeting.

Discussions at the meeting determined that the central topics for discussion at the fourth annual meeting would be: the perfection of Chinese-built units (including thermoelectric and hydroelectric units), the energy conservation of thermal energy and power equipment, and the transformation to and use of nuclear energy and new sources of energy. The fourth annual meeting will sum up China's scientific research achievements and experiences in the field of power engineering since the third annual meeting, and investigate the scientific and technological policies, direction of development and focal points for present and future work.

The council agreed that the main contents of the fourth annual meeting will be: academic exchange and discussions of special topics, new elections for the council, to commend the institution's activists, to determine ideas for the work of the institution during the 1983-1985 period and to organize and build up editing and publishing work.

The meeting discussed and revised the means of soliciting and appraising articles for the fourth annual meeting of the Power Engineering Institution. They also agreed that the fourth annual meeting be held quarterly in 1982.

4. Editing and Publishing

During the meeting, the institution's editing and publishing committee held an enlarged conference where they reviewed and summed up the editing and publishing work done since the third annual meeting. They also listened to work reports from the editorial department of the institution's journal "Power Engineering" and discussed the policies, plans and organization of editing and publishing as well as the sources of manuscripts and the setting up of a communications network. Finally, a comprehensive report was presented to the entire council meeting.

5. Organizational Construction and Other Matters

This council also discussed the organizational construction of specialized committees, the organization members and how to succeed in secretarial work. There were identical views on these problems.

Finally, the meeting hoped that each specialized committee would make the be best use of their time and vigorously prepare by first accomplishing the various specialized academic activities in 1982 and holding the fourth annual meeting. At the same time, they must further consider ideas for the organization during the 1983-1985 period so that organization activities will better serve the building of the four modernizations and further promote the development of power engineering undertakings.

TWO COMPUTER SERVICE FIRMS ESTABLISHED IN CHENGDU

Chengdu SICHUAN RIBAO in Chinese 18 May 82 p 1

[Article by Wang Tong [3769 1749] and Yan Weipian [0917 3634 7478]: "Sichuan Branch of the China Computer Technology Service Compnay, Sichuan Provincial Computer Technology Popularization and Service Company Are Established in Chengdu"]

[Text] With approval by the State Computer Industry Bureau and the leading departments of the Sichuan Provincial Government, the Sichuan branch of the China Computer Technology Service Company and the Sichuan Provincial Computer Technology Popularization and Service Company were officially founded in Chengdu on May 15.

These two companies are enterprises jointly managed by related departments of our province and related departments of the Central Government. They are also one of the points of the key computer technology service network throughout the nation. Their establishment will better promote the popularization and application of computer technology in the various sectors of the national economy in our province and in the neighboring regions.

These two companies in the province are also a joint body. At present, besides the headquarters of the companies, the Chengdu City Computer Service Company has joined the Emei Radio Plant. In the future, along with the application and development of computer technology, more units will be organized and joined together.

These two companies are under the joint leadership of the China Computer Technology Service Company and the Sichuan Provincial Fourth Machinery Industry Bureau. The companies operate independently and practice independent accounting. Their main services include the development of computer technology, its popularization and application and technical services.

Secretary of the Provincial Committee He Haoju [0149 6787 3515], Deputy Governor of the Provincial People's Government Liu Haiquan [0491 3189 3123], responsible comrades and delegates from related departments of the Ministry of Electronics Industry, the Computer Industry Bureau, and the China Computer Technology and Service Company attended the founding ceremony of the two companies. Deputy Governor Liu Haiquan spoke at the ceremony.

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CSO: 4008/181

ARTICLE REPORTS ON USE OF ELECTRONIC COMPUTER TECHNOLOGY

Chengdu SICHUAN RIBAO in Chinese 16 May 82 p 1

[Article by reporters Wen Xianshu [2429 6343 2579] and Yan Weipian [0917 3634 7478]: "Some Enterprises in Our Province Have Begun to Use Computer Technology, Better Achievements have Been Realized in Promoting Technical Reform, Increasing Production and Elevating Management Standards"]

[Text] The Sichuan branch of the China Computer Technology and Service Company and the Sichuan Provincial Computer Technology Popularization and Service Company carried out the spirit of making preparations to establish themselves and providing services simultaneously, actively launched the work of applying and popularizing computer technology and providing services. They have realized better results.

The computer is a high speed computational tool. It is also an economical information management system. Its scope of application is very broad. Especially today when modern science and technology are rapidly developing, it is an indispensable and important means to promote technical improvement of the various sectors of the national economy and the progress in the development of building the four modernizations. Since the second half of last year, they cooperated with some enterprises in the metallurgical profession, machinery profession, textile profession, timber profession, and electric power profession to popularize and apply this new technology. This has visibly served to improve the level of production and management of these enterprises. Take the Chengdu Log Storage Yard as an example. With the help of the companies' member unit, the Emei Radio Plant, this log storage yard used the computer to automatically control inspection and measurement of logs so that processing logs from the mouth of the river to measuring, calculation of the volume of timber, and the classificiation of timber were all automatically controlled. This not only increased the accuracy of inspection and measurement greatly, it also greatly reduced the workers' labor intensity. Now, people can see at the site that regardless of the specifications of size and length of the timber, its volume can be accurately calculated and obtained in an instant while the logs are run through the computerized and automated control system for inspecting and measuring timber. According to measurements by the yard, because the computer was used to inspect and to measure logs, the error rate in inspection and measurement of timber has dropped from the original 10 percent to 3 percent.

Calculating at the rate of storing 500,000 cubic meters of timber a year at the yard, the annual error can be reduced by 35,000 cubic meters. Again, for example, one of the founding members of these companies--the Chengdu City Electronics Research Institute--cooperated with the Fourth Subsidiary Plant of the Changjiang Steel Mill. According to the currently available equipment and production technology at the Fourth Subsidiary Plant of the Changjiang Steel Mill, a system for automatically reporting the results of pre-furnace analysis of steel samples was developed. The system was connected to the original E600 model direct reading spectral analyser in operation. Besides completing the entire process of analyzing steel samples, the results of analysis of steel samples were printed out before the steel entered the smelting furnace. Automated reporting of the results of analysis of steel samples before entering the furnace was realized. The reliability of the measured data of the original simulator equipped with the F600 direct reading spectrograph was poor. The computational speed was slow. The consistency of the same data was poor. After using a digitizer, the reliability of the measured data was high, the speed was fast and consistency was good. The results were more visible especially when this system was used in place of manual inspection of the curves. The improved speed of computation and the printout of the results of analysis before entering the furnace shortened the time of smelting steel of each furnace by 15 minutes and in this way, 13,500 kilowatt-hours of electricity could be saved a day. Because the reports were in time, visible results were obtained in guaranteeing the quality of the steel and reducing the consumption of raw materials. During the period of preparation of these two companies, four learning classes were held in response to the demand of users and they trained more than 200 technicians for the users. The classes were deeply welcomed by the users.

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CSO: 4008/181

INTRODUCING NEW TYPE OF INDUSTRIAL HIGH PRESSURE VESSEL

Hangzhou ZHEJIANG DAXUE XUEBAO [JOURNAL OF ZHEJIANG UNIVERSITY] in Chinese No 1, Mar 82 pp 84-89

[Article by Zhu Guohui [2612 0948 6540]: "A New Type of High Pressure Vessel of Wound Flat Steel Ribbons With a Thin Inner Tube"]

[Text] Abstract

High pressure vessels are widely used in the chemical industry, petroleum industry, atomic energy industry and other industries.

Because the body of ordinary high pressure vesels is long, the diameter is large, the wall of the vessel is thick and the vessel must be safe and reliable in use, it is very difficult to manufacture. This article introduces a "new type of high pressure vessel with wound flat steel ribbons and a thin inner tube." The vessel is rationally structured, simple to manufacture, highly efficient, low cost and safe to use. At present, over 3,000 of this new wound ribbon type high pressure vessel with a diameter of ϕ450 to ϕ1,000 millimeters and that can sustain a pressure of 150 to 320 kilograms/square centimeters have been successfully used in our nation.

I. Introduction

High pressure vessels are widely used in modern industry and technology [1][2]. For example, the ammonia synthesis tower, the urea synthesis tower, the methanol synthesis tower, petroleum and coal hydrogenation facilities, vessels for the atomic reactor, energy storage vessels for large hydraulic press and containers for artificial gems are all precious and key pieces of equipment in modern industry and technology.

Because of the trend of development towards largeness in such industries as chemical engineering, petroleum and atomic energy, larger and larger inner diameters, lengths and wall thickness of high pressure vessels are required.

The inner diameter of some vessels can reach ϕ4,000 millimeters, the lengths can reach 40 meters, the thickness of the wall can reach 300 millimeters and the weight can reach over 300 tons. This has presented unusual difficulties in manufacturing [3].

The first high pressure vessels--the barrels--were cast in a lying position. But high pressure vessels used in the ammonia synthesis industry were cast in whole from the beginning. This was because casting easily caused crumbling type explosions. But whole body cast high pressure vessels required large hydraulic presses of the 10,000-ton class, large lathes and boring lathes, and large heat treatment furnaces. The manufacturing technology must be high and the amount of cutting and processing was very large. The efficiency was low, the cost was high and manufacturing was difficult. This prompted people to find out whether steel plates could be made into a relatively thin outer surface of inner tubes and whether they could be encased by hot outer tubes, and even whether steel ribbons or steel mesh could be wound into high pressure vessels. But, the high pressure vessels with both ends sealed must bear the axial force of internal pressure and they required that the thickness of the inner tube should not be smaller than half the total thickness of the container, therefore, placing an inner tube with a thickness less than half the total thickness of the container inside a hot hoop tube or winding ordinary steel ribbons on the outside would not produce rational high pressure vessels. This resulted in the emergence of the "vessel with a thick inner tube of wound ribbon" [4] and the "vessel with a thick inner hoop tube." But these two types of high pressure vessels with "thick inner tubes" could not be made from ordinary steel plates because the inner tube was still too thick. Frequently, they were still very difficult to manufacture. Thus, a development trend in two other directions emerged later: One direction continued to reduce the thickness of the inner tube and thus the two types of high pressure vessels of the famous "framed threat wound" type and "formed ribbon clipping" to bear the axial force of internal pressure. The other direction of development was to manufacture high pressure vessels by welding together several tube segments of shorter lengths. A technique of "welding thick rings at the seams" using single layer or multiple layer thick walled tube segments to form a sufficiently long high pressure vessel was developed to bear the axial force on the end caps. This produced the "forge welded type," "thick rolled plate welded type," "multiple layer wrapped type," "tube segment wound plate type," "spiral wrapped type," "multiple layer hot cased type" [6] high pressure vessels. The "formed trough wound ribbon type" and the "multiple layer hot cased type" are the two types of high pressure vessels widely used in Europe and the United States at present.

But, regardless of whether it is "formed ribbon clipping" or "thick rings welded at the seams," they still require special and difficult technology because of the following:

When using "formed ribbon clipping " (See diagram 1a):

1. The exterior wall of the inner tube requires the use of especially large (reaching 50 meters long) lathes to process the tube into a concave and convex trough that can bear the axial force. Its manufacturing techniques are relatively difficult.

2. The requirements of the technique of binding special steel ribbons with a section of three or five troughs are very high.

3. The requirements for "clipping" the wound layers are strict, and unidirectional winding will cause the inner tube to "un-clip" due to twisting, and finally, the axial force in the inner tube will be too large and the tube will break.

4. The thickness of the inner tube made by unidirectional winding of steel ribbons is thin and the lateral rigi cy of the vessel is relatively weak.

When using "thick rings welded at the seams" (See Diagram 1b):

1. Large specialized end surface processing machine tools are needed to process the slanted lips of the ring seam for welding each of the thick walled tube segments.

2. When welding a large number of thick, narrow and deep rings at the seams, the welding technique itself is an especially difficult technique. Defects such as cracked seams, the presence of impurities and not welding through the material easily occur and a large amount of welding rods and electricity must be used.

3. Non-destructive inspection of defects of deep trough ring seams is also a difficult technique not only because the thickness creates difficulties for inspecting the defects but also because one ring seam has to be moved and transported back and forth and inspected many times to avoid overlooking any defects during inspection and repairs are difficult.

4. Welding thick rings at the seams produces a "waist hoop" in the vessel causing sudden changes in stress in multiple layer vessels. Cracks in the welded seams and such defects may enlarge in single layer welded ring seams and cause low stress breaking.

Therefore, for many years, the direction of international research in high pressure vessels has been to improve and eliminate "formed ribbon clipping" and "welding of thick rings at the seams," to simplify manufacturing techniques, to improve the degree of mechanization of the manufacturing process, to reduce the requirements for raw materials, to avoid hidden defects of large cracks, and to guarantee safety and reliability in use.

Aimed at the above situation, the Soviet Union successfully developed a type of "high pressure vessels of spiral wound plates" in 1978 and planned to develop large diameter high pressure vessels [7]. The width of the plate was between 1,000 and 1,500 millimeters. Each layer was wound from a single head and the angle of inclination was about 10° to 15°. Here, it is worth using large and strong rolling lathes and difficult end processing techniques to eliminate "formed ribbon clipping" and "welding thick rings at the seams." The fact that such wide steel plates have to be rolled layer by layer and several wound plates have to be welded together to increase the axial strength of the vessel is sufficient to show that the problems existing internationally in the manufacturing of high pressure vessels at present are still very serious.

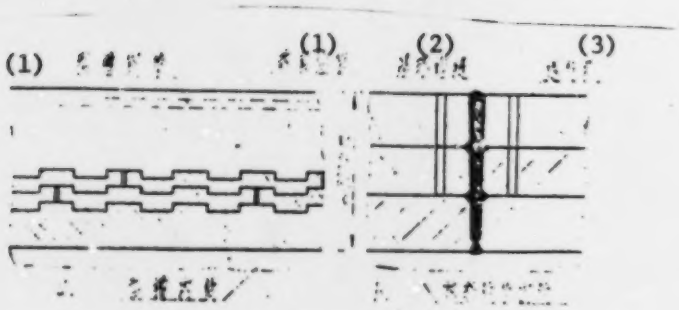

Diagram 1 "Formed ribbon clipping" and "thick rings welded at the seams"

a. Formed trough inner tube

1. Formed trough steel ribbons

b. Inner tube of hot cased tube segment

1. Hot cased tube segment
2. Thick ring welded at the seams
3. Air hole

II. Basic Structure and Main Characteristics of the New Type of Wound Ribbon Vessels

The structural principle of this new type of wound ribbon high pressure vessel of our nation was proposed in 1964. It was tested in our school's chemical machinery laboratory [8]. Later, under the guidance and support of the director of the original Hangzhou Boiler Plant and national model worker Chen Yousheng [7115 2589 3932], director of the original General Machinery Research Institute of the First Ministry of Machine Building Su Youquan [5685 0642 3123] and our school's Professor Wang Rendong [3769 0117 2639], our school cooperated separately with the Hangzhou Boiler Plant, the General Machinery Research Institute of the First Ministry of Machine Building and the Nanjing Second Chemical Machinery Plant to develop industrial products. Success was achieved in 1965 one after the other. Then, the products were rapidly popularized and applied in our nation. Up to now, there are 10 factories in the nation producing various types of high pressure vessels and more than 3,000 have been used throughout the nation. They have brought visible technical and economic results to the nation. Their design received the third class invention award by the Inventions Evaluation Committee of the State Scientific and Technological Commission on January 30, 1981.

Basic Structure:

This type of vessel consists of a thin inner tube, a tube flange and bottom cap and a layer of flat wound steel ribbons (See illustration in Diagram 2). The thickness of the inner tube is 20 to 25 percent the total thickness of the vessel, the thinnest can be 10 percent and the thickness can vary within

a relatively large range. The manufacture of the inner tube is the same as that of ordinary medium and low pressure vessels, but its quality requirements are higher. The flanges at the ends are usually forged. They can also be multiple layer flanges. The bottom cap can be punched into a spherical shape using single layer or multiple layer steel plates. They are all made with a 30° to 40° taper to enable the top and bottom ends of the steel ribbons to be welded together. The width of the flat steel ribbons has various specifications from 20 to 200 millimeters and the thickness has various specifications from 2 to 8 millimeters. The flat steel ribbons are wound on the outside of the the inner tube by a special structural principle using the cold winding method or hot winding method. To protect the steel ribbons from rain, a thin protective plate of 1 to 2 millimeters thick is wrapped on the outside of the final wound ribbon layer.

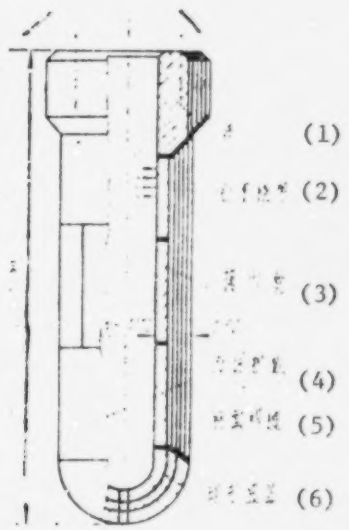

图 2　新型绕带高压容器示图

Diagram 2 Illustration of the new wound ribbon high pressure vessel

1 Flanges 2 Flat wound ribbon 3 Thin inner tube 4 Protective plate
5 Slanted surface of welded seam 6 Spherical end cap

(I) Manufacturing Characteristics:

Because of the following reasons, the production efficiency of the new wound ribbon high pressure vessel can be visibly improved, the manufacturing cost can be greatly lowered, and these characteristics can be used to manufacture large diameter and ultrahigh pressure vessels:

1. The thickness of the inner tube constitutes only 10 to 25 percent of the total thickness of the vessel. Manufacturing has been greatly simplified. Steel plates of ordinary thickness are suitable for the needs in manufacturing large sized high pressure vessels.

2. Most of the raw materials used are flat steel ribbons that are easily bound and that are low cost. Regardless of the diameter and the thickness of the wall of the vessel, all of the raw materials are suitable.

3. The wound ribbon layers only have to be close together without being "clipped" together. In this way, the thickness of the wound layers can be thicker than that of formed trough wound ribbon containers. This also completely eliminates processing formed troughs of the inner tube on large lathes.

4. Most of the thickness of the vessel consists of wound ribbon layers, therefore, the amount of work in massive welding, inspection of defects and hot processing is reduced. In particular, it avoids welding thick rings at the seams and hot processing the whole piece. The consumption of welding rods, electricity and transparent film can be reduced by 80 percent.

5. The winding of steel ribbons can be realized using a simple ribbon winding facility. As long as the facility is equipped with appropriate tools to weld, buff and pack the steel ribbons, the winding quality of the steel ribbons can be more easily guaranteed, and the steel ribbon winding device can have a higher efficiency. The manufacturing process is basically to add the steel ribbon winding procedure to the manufacturing of the inner tube. Thus when winding of the steel ribbons has been completed, the vessel is basically completed. There are few procedures and the manufacturing period is short.

When compared to the three-layer hot cased vessel [9] [10] believed internationally to be more advanced at present, the production efficiency of the new wound ribbon vessel can be improved by more than onefold and the cost can be lowered by 30 to 40 percent. The economic result is very visible and our vessel is more suitable for enlargement compared to the vessels of spiral wound plates of the Soviet Union.

(II) Strength Characteristics:

Many tests were conducted with this type of wound rigbon vessels with an inner diameter of ϕ40 to ϕ100 millimeters and a designed pressure of 150 to 320 kilograms/square centimeters. The results showed:

1. The explosion pressures of the vessels all reached over 3 times the internal working prssure with the highest reaching 2,140 kilograms/square centimeters, and because the rate of utilization of materials was improved, the consumption of steel materials was about 20 percent less than that of the multiple layer wrapped vessels.

2. The axial strength of the vessels was sufficient, i.e., the thickness of the inner tube constituted only 15 percent of the total thickness of the

vessel. Also, axial breaking like that which occurred at the time of explosion of the formed trough wound ribbon vessel did not occur. For example, a new type of wound ribbon vessel used in production at present has an inner diameter of ϕ60 centimeters. The thickness of the inner tube is 1.6 centimeters. The vessel has a total of 14 wound layers of flat steel ribbons. The thickness of the wound layer is 5.6 centimeters. The allowable stress of the steel ribbons $[\sigma_w]$=1,700 kilogram/swuare centimeters, and the internal working pressure P_i =320 kilograms/square centimter. At this time, the axial load of this type of wound vessel is:

$$P_i' = \frac{2 \cdot Y_{wm} \cdot S_w \cdot Q \cdot [\sigma_w]}{} = \frac{2 \times 34.6 \times 5.6 \times 0.5 \times 1700}{30^2} = 365$$

kilograms/centimeter > P_i ,

i.e., the wound ribbon layers alone can bear all of the axial force of the internal pressure of the vessel. In the formula, Q is the coefficient of force that can be borne axially by the wound ribbon layers calculated theoretically and experimentally measured.

3. Success has also been achieved by drilling holes in the wall of this type of vessel to connect pipes. A hole of ϕ260 millimeters was drilled on a vessel of this type with an inner diameter of ϕ500 millimeters. After 200 hydraulic pressures tests, we found that its explosion pressure still reached 1,140 kilograms/square centimeters (the internal working pressure was 320 kilograms/square centimeters).

4. Because pre-stressed winding of steel ribbons will cause the inner tube to contract circumferentially and axially, the circumferential contraction can reach 0.1 to 0.15 percent of the inner diameter di of the vessel. This is equivalent to the excess in fit of the unprocessed hot cased vessel. Axial contraction can also reach 0.1 percent of the length of the vessel. After winding 12 layers of steel ribbons of a wound ribbon vessel of this type with an inner diameter of 500 millimeters and a length of 1.6 meters, the inner diameter shrinks an average of more than 0.6 millimeters and the length shortens 1.69 millimeters. When the interior is pressurized to 400 kilograms/square centimeters, the axial length of the vessel will be restored to only 1.63 millimeters and there is still a contraction of 0.06 millimeters. This shows that even under excess working pressure, the axial length of the inner tube is still compressed somewhat while the external layer of steel ribbons still has a safety margin established by the designed standards. Based on this situation, we have proposed a "low stree inner tube" design [11] for this type of wound ribbon vessels so that the circumferential and axial lengths of the inner tube will basically not bear tensile stress under working pressures. This type of high pressure vessel with an inner tube that "does not open" is being sought by international efforts. It is not difficult to realize with this new type of wound ribbon vessels.

(III) Safety Characteristics

The new type of wound ribbon vessel has the following outstanding structural characteristics [12] in guaranteeing safety in use:

1. The inner tube is thin: This is the key part of the vessel bearing internal pressure. Because it is thin and easy to manufacture, the quality is more easily guaranteed. There are few hidden defects. And it can be treated by pre-stressed winding or excess strain [13] so that the circumferential and axial lengths are compressed beforehand. This is beneficial to preventing the enlargement of cracks.

2. The steel ribbons are thin: This is an important indicator of superior quality material. Because the thickness of the flat steel ribbons is only 2 to 8 millimeters, the vessel possesses the properties of good metallic fibers. The quality of the material is more reliable, and the temperature that induces a change in brittleness is lower, the toughness in breaking is improved, and crumbling type fragments can be completely avoided.

3. There are many layers: This is the key factor preventing the vessel from exploding due to brittleness. Because the thickness of the vessel consists of many layers of thin sections and because there are no welded seams of thick rings along the entire length, the gaps between layers serve to "stop cracks." The wound layers also provide full protection of the inner tube, therefore, under internal working pressures, this type of vessels will not explode in whole due to low stress brittleness.

4. The two ends are slanted and scattered welded seams: This is an effective measure to prevent the flanges or the bottom cap from breaking and flying out and causing serious incidents. This is because, when the deep and thick ring seams are changed to slanted and scattered welded seams (Diagram 3), the area of the welded seams under force is increased so that welding is greatly simplified. Also, because the structure of the welded seam has been changed, even if point a of the ring seam of the inner tube breaks, the slanted surface of the welded seam at point b of the wound ribbon layer will not immediately enlarge the crack and cause the cap to fly apart.

5. The wound ribbon layers have many natural warning "air holes": This provides natural conditions to release air, depressurize the vessel and prevent explosion. Because the winding process of this type of wound ribbon vessel can form natural bends as air release channels, these channels are not only beneficial to releasing and removing hydrogen and reducing erosion by hydrogen, they also provide very favorable conditions for releasing air and depressurization and prevent the vessel from exploding as a whole.

Theoretical analysis and practice all prove that this type of wound ribbon vessel can completely avoid sudden explosions due to brittleness under normal operating conditions.

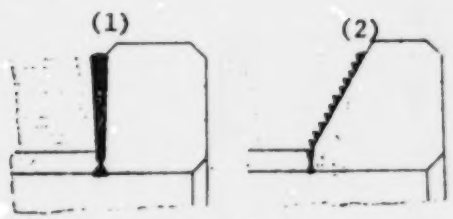

图3 厚环焊缝与斜面分散焊缝

Diagram 3 Thick ring welded seam and slanted and scattered welded seam

1 Multiple layer warpping 2 Flat wound ribbon

III. Future for the Development of New Types of Wound Ribbon Vessels

According to reports, the formed trough wound ribbon high pressure vessel developed by West Germany has an inner diameter of ϕ3,500 millimeters, a length of 40 meters, a wall thickness of 300 millimeters, a working temperature of 350°C, an internal working pressure of 3,000 kilograms/square centimeters and a weight of more than 300 tons [14].

According to the characteristics of our nation's new wound ribbon vessel described above and compared to the West German formed trough wound ribbon vessel, the new wound ribbon vessels will develop in the following aspects:

1. They will be used in manufacturing large diameter high pressure vessels:

Because the required thickness of the inner tube of the new wound ribbon vessel is thinner than that of the formed trough wound ribbon vessel while the winding of flat steel ribbons is much simpler than that for formed trough steel ribbons and spiral wound plates, as long as a large and simple winding lathe can be fitted (simpler than the lathe for the spiral wound plates and with less power), various types of large high pressure vessels can be wound.

2. They can be used in manufacturing ultrahigh pressure vessels:

Because the layers of the new wound ribbon vessels do not need to be "clipped together" but only placed close to each other, thus, according to the past practice of winding 28 layers of steel ribbons, the ribbon winding machine tools currently available need only slight modifications to manufacture various types of thick vessels of less than 30 layers but can sustain ultrahigh pressures, such as high temperature equal static pressure vessels.

3. They can be used to manufacture special high temperature, low temperature, anti-erosion and anti-radiation vessels:

Because the new wound ribbon vessel consists of many layers, the materials for the internal and external layers and between layers can be changed according to requirements, and the inner tube can be thinner (still possessing better rigidity), therefore they can be more easily adapted to high temperature, low temperature and anti-erosion requirements, such as the high pressure and high temperature vessels used in manufacturing petroleum and for coal hydrogenation reactions.

4. They can be used to manufacture various types of pressure vessels or gas bottles of fixed shapes that do not require opening large holes in the walls and that require a relatively fixed wall thickness to improve the safety and reliability of high pressure vessels.

Because the new wound ribbon vessel is a type of truly multiple layer composite vessel, its manufacture is not only simple, there are less hidden defects, the gaps between layers can prevent cracking, the outer layer can serve a protective function, therefore, it is possible for the pressure vessel to "leak but not explode" under operating pressures and avoid possible serious consequences due to explosion caused by low stress brittleness. This can gradually change people's fear of pressure vessels and especially high pressure vessels.

In summary, this type of new wound ribbon vessel of our nation still has many problems that need to be studied in depth, solved and perfected in theory and in practice. Its future for development in the international arena will gradually manifest itself before us!

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CHINESE HUMAN DIMENSIONS, THEIR APPLICATION IN DESIGN OF MOTOR VEHICLES

Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 2, 1982
pp 54-60

[Article by Wang Qiyuan [3769 6386 3293], Qi Huiwen [7871 1920 2429] of the Changchun Motor Vehicle Research Institute: "Physical Dimensions of the Chinese and Their Use in Automobile Designs (Part II)--Brief Introduction to the Dimensions of the Operating Position of the Driver of the JB2667-80 Truck"]

[Text] 5. The Concept of the "Standard Human Body" and the Application of Human Physical Dimensions

When we established the interior dimensions (preliminary design stage) of the driver's cab in the past, we used a 1:5 "standard human body" as the model for measurements to examine whether the dimensions of the operating space of the driver were appropriate. Now it seems that using this method of arrangement does not take into consideration the overall situation. For example, if we use the average "sitting height" to determine the dimension between the cushion of the seat and the roof, 50 percent of the people with physical dimensions larger than the average values will feel there is insufficient head room between the top of the head and the roof. Also for example, if we use the average height of the bend of the leg to design the height of the seat and cushion, then 50 percent of the people with physical dimensions smaller than the average values will not be comfortable because their feet cannot reach the floor and there will be too much pressure against the underside of the thighs, and these drivers will quickly become tired and their legs will become numb.

The arithmetic averages calculated from measurements are used only to explain the trend of concentration of one dimension. Actually, a "standard human body" completely possessing average dimensions does not exist. The possibility that a person possesses several average dimensions is very small. This can be explained by using the dimensions of men measured as an example:

Among the 864 people measured, the height of only 168 people generally coincided with the average height (1,675 to 1,700 millimeters), constituting

19.45 percent of the total, Among these 168 people, only 70 persons had a seated height generally coinciding with the average (885 to 905 millimeters), constituting 8.1 percent. Among these 70 persons, there were only 20 people with an outstretched upper arm length coinciding with the average (830 to 845 millimeters), constituting 2.32 percent of the total. Among these 20 persons, only 10 had an upper arm length generally coinciding with the average (265 to 275 millimeters), constituting 1.16 percent of the total. Among these 10 people, only 2 people had an outstretched lower limb length generally coinciding with the average (1,010 to 1,025 millimeters), constituting 0.232 percent of the total. Between these two people, the width of the buttocks of only one generally coincided with the average (325 to 340 millimeters), constituting 0.116 percent.

Thus it can be seen that a person who has four physical dimensions coinciding simultaneously with the average dimensions is a "rare find within a hundred li." This does not have any meaning in practical application. The probability of a person simultaneously having six physical dimensions coinciding with the average dimensions is one in one thousand. This says, the "standard human body" with all dimensions coinciding with the average dimensions actually does not exist.

Then, what is the meaning of the various average dimensions of the human body measured here? It has already been proven previously that the dimensions of the human body show a normal distribution, and their density function is as shown in Diagram 3. The μ , σ we measured have a clear meaning in probability. The value of σ represents the degree of scattering of the distribution. The greater the σ, the greater the degree of scattering. The Gaussian curve is flat. The smaller the σ, the more pointed the curve. The μ represents the location of concentration of distribution. The density is the largest near μ . We know from the characteristics of normal probability that 95.6 percent are distributed between -2σ and $+2\sigma$.

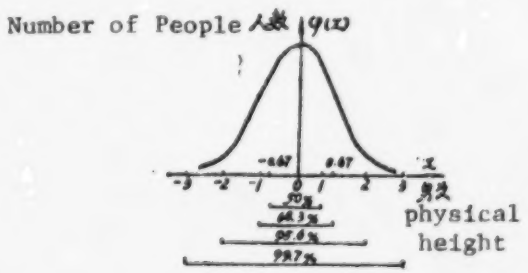

Diagram 3 Normal distribution of the height of the human body

Therefore, it is a mistake to take the arithmetic averages as the basis for designing human physical space. The average values must be used jointly with the standard deviation σ --which explains the degree of scattering before the average values can represent the dimensions of the human body of the majority.

Take the body length that we measured as an example, the average μ of the body length of men was 1,688.25 millimeters, the standard deviation was 81.83 millimeters. When we take ($\mu - 1.645\sigma$) to ($\mu + 1.645\sigma$), i.e., from 1,550 to 1,820 millimeters, the men with dimensions within this interval constitute 90 percent of the total number of men.

Because the traffic control departments of each province have ruled that the height of the driver must not be less than 1,550 millimeters, therefore the lower limit of height of women need not be considered while the upper limit of height of women is less than 1,820 milimeters. Therefore, when designing the body of the vehicle, it is sufficient to consider only those people with a height between 1,550 and 1,820 millimeters.

6. Foreign Ergonomics

Foreign nations have special groups to study human physical dimensions, weight, physiology and their relationship to driving operations and a lot of research and measurements have been done. For example, the ergonomics group of Boeing Company of the United States and the SAE human model group have since 1944 conducted broad human physical measurements and surveys of American military personnel. The most recent survey was conducted by the U.S. Department of Health in 1960-1962. A total of 6,672 American adults between the ages of 18 and 79 were selected by race, geographical origin, social origin, economic status to represent non-military personnel. They were measured according to various criteria and the percentages were computed by computer. In the United States, the measurement of human physical dimensions is done very thoroughly. For example, there are: dimensions of the joints of the human body, exterior dimensions, dimensions when wearing clothes, dimensions added to the person in cold areas, and even down to the dimensions of the top hat, the straw hat, ordinary shoes, women's high heels, etc. The weight of the physical body is also finely measured. The weight of the human body is further divided into the weight of the head, the chest, the stomach, the upper arm, the lower arm, the hand, the thigh, the shank and the foot. They all have specific weight measurements. These are measured for making three-dimensional models of the human body and for determining the weight distribution of dummies used in collision tests.

In recent years, the question of how to coordinate the relationship between machine and man has attracted the attention of various nations. Because all machines and equipment must be operated by people and must serve people, therefore the application of research results of "ergonomics" will help improve man's working conditions and improve the efficiency of machines. Therefore, major industrial nations of the world today have all established Human Engineering Societies to see to it that engineering designs and standards coincide with the requirements of human engineering. For example, Britain and West Germany have reviewed the standards established in the past according to the requirements of human engineering.

Besides the establishment of human engineering societies in foreign nations, the International Standards Organization (ISO) has especially established a

new technical committee--Human Engineering Committee (ISO-TC159) to especially study the problems of standards in human engineering.

The Road Vehicle Technical Committee (ISO/TC22) also has a subcommittee (SC13) for the "application of human engineering in road vehicles." The subcommittee has many subordinate working groups (WG) engaged in studying the application of human engineering in road vehicles and drawing up related standards.

II. Dimensions of the Operating Position of the Truck Driver

1. General Description

In recent years, as high speed highways are built, as the speed of vehicles increase, the efficiency of automobile transportation has visibly improved. In special transport companies, drivers spend most of the time inside the driver's cab. While driving, the driver must frequently observe the road surface, reduce speed, change gears and operate various manual switches. Therefore, how to enable the driver to sit comfortably while driving at high speed and while working for long hours, save his strength in operating the vehicle and reduce fatigue are very important to safe driving.

At present, every nation has paid special attention to the arrangement of the position of the driver's seat and the various types of operating mechanisms in trucks. A lot of progress has been made in improving comfort. For example:

(1) There is the use of the "suspension seat," i.e., the back and the cushion are made into a whole. At the bottom of the seat are installed springs and shock absorbers. This way, there is no positional shift between the back and the seat cushion and thus "rubbing the back" is eliminated. On the other hand, while driving on roads of poor condition, the amplitude produced by the seat can quickly dissipate.

(2) There is the use of the "bucket seat" that coincides with the shape of the human body. The angle of the seat cushion and the back can all be adjusted, thus increasing the seat's support of the human body and improving the comfort of the ride. Bucket seats can also eliminate the sideways sliding of the driver when driving on winding roads.

(3) Some seats have head rests and the angle of the head rests can be adjusted to reduce muscular fatigue of the neck while driving long distance. The head rests also prevent the neck from damage in "tailing" accidents.

(4) The steering wheel of the Japanese "Fukuha" FK series trucks can be adjusted within a range of $\pm 3°$ to adapt to the operation of different drivers.

(5) Some manually operated buttons are arranged so that they can be easily reached, and necessary and bright warning lights have been installed

on the instrument panel, thus reducing the driver's physical and mental fatigue.

In general, efforts should be made to appropriately arrange the position of the driving mechanisms so that operation of the vehicle takes less effort and the ride is comfortable. These efforts will improve safety in driving.

2. The Relationship Between Human Body Engineering and the Arrangement of the Driver's Cab

The driver's cab is the place where the driver operates the vehicle and rests, therefore, to arrange the interior of the driver's cab rationally, we must understand the dimensions of the various parts of the human body, especially the distances between the joints and the area of activity of the four limbs.

The arrangement of the interior dimensions of the driver's cab is centered around the activity of the driver. We should start out from maneuverability, comfort and safety and develop a design that suits the whole arrangement of the entire vehicle. Rational arrangement enables the driver to sit comfortably, to maneuver easily and to have a good view. This will keep the driver from feeling tired in long distance driving, improve traveling speed and reduce the occurrence of accidents.

The basic consideration for the arrangement of the interior dimensions of the driver's cab is the sitting position of the driver in the seat. The sitting position is determined by the use and the type of the vehicle.

In large trucks, the so-called "upright sitting position" is used a lot. The steering wheel is near the horizontal position. The main consideration is to make it easy to operate and to enable the driver to apply a large force. The reason that reducing the angle of inclination of the steering wheel can increase the force of exertion is that when the angle of inclination of the steering wheel is very small, the lower arm and the upper arm muscles can all participate in maneuvering. When the angle of inclination of the steering wheel is very large, only the muscles of the lower arm can maneuver.

In a sedan, the so-called "comfortable position" is used, i.e., the main consideration is that the driver can sit in this position for long periods without feeling tired.

In the "upright sitting position," the force is the first factor. In the "comfortable position," speed is the first factor. The arrangement of the mechanisms is first determined by considerations for swift and rapid operation (See Diagram 4).

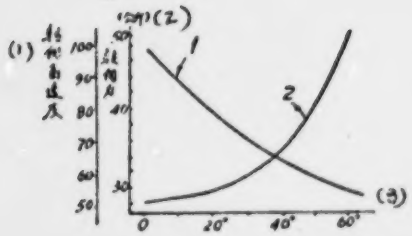

Diagram 4 Angle of inclination of the steering wheel and the angular speed of turning

KEY: (1) Angular speed of turning
(2) Kilogram
(3) Angle of steering column

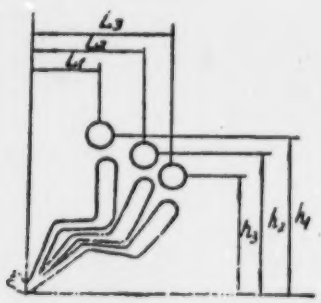

图5 驾驶员座姿与车身布置的关系

Diagram 5 Relationship between driver's sitting position and arrangement of the body of the car

In flat nosed trucks, because the steering wheel is relatively level, therefore the drivers mostly sit in the "upright position," i.e., the dimensions required in front and in back are smaller while the dimensions in height are larger (See L_1 and h_1 in Diagram 5).

In long nosed trucks, because the steering wheel is more slanted, the drivers mostly sit in the "comfortable position," i.e., the dimensions required in front and in back are larger while the dimensions required in height are smaller (See Diagram 5).

It can be seen that for different models of vehicles, the sitting positions are different and the dimensions of space occupied are also different. But the dimensions of the body of the driver are all the same.

Most of the maneuvers of the driver are performed by the hands and feet. The maneuvers must be correct and they must be able to apply sufficient force. In operation, attention must not be overly distracted thus hindering observation of the road. This is determined to a large degree by the arrangement and structure of the operating mechanisms and the dimensions of the driver's cab and their arrangement.

The arrangement of the operating mechanisms should be within the range of activity of the hands and feet and they should be easily and rapidly within reach. Especially frequently used operating mechanisms should be arranged in the best activity range of the hands and feet. This is very important to shortening the maneuvering time. For example, when driving at 70 kilometers an hour, the vehicle advances about 20 meters per second. Obviously, any design measure that can save 0.1 second will greatly improve safety. For example, in the ISUZU "Fahua" SBR and JBR trucks, the turning light switch, the windshield wiper switch, the light switch, the hand brake are all arranged on the steering column where they can be easily reached.

Diagram 6 and Diagram 7 show the largest and the best operating space for the hands and feet recommended in the SAE J898a of the United States. In the "best" operating space, the operating mechanism can be reached the most rapidly and the most accurately and the operating strength is the greatest. This space is the most ideal. The "largest" operating space is acceptable for operating mechanisms that are not frequently operated and not used for emergencies.

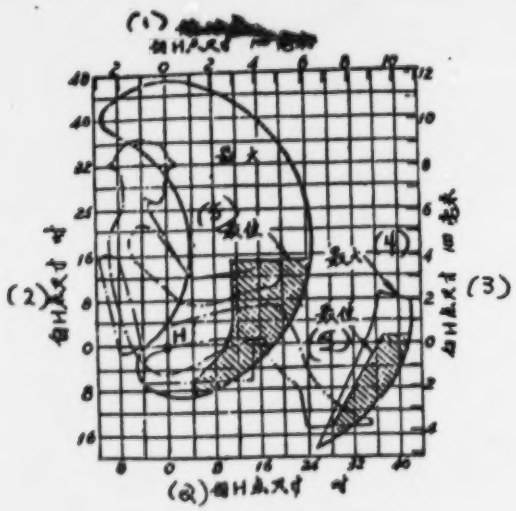

Diagram 6 The best and largest operating space for the hands and feet at low point H [In the diagram, the person represents the physique of 95 percent of relatively tall American males; the seat is in the last adjustable position of the forward and backward adjustments (if 4 inches are allowed for forward and backward adjustment, the best operating space can be provided

for 90 percent of the drivers. Consideration also includes the situation in which the driver is not sitting upright but is slouching by 1 inch).]

KEY: (1) Low point H, dimensions from point H, 100 millimeters
(2) Dimensions from point H, inch
(3) Dimensions from point H, 100 millimeters
(4) Largest
(5) Best

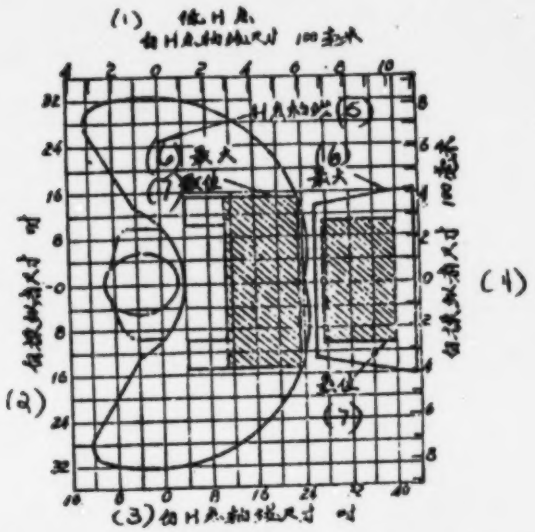

Diagram 7 The best and largest operating space for the hands and feet at low point H (in the diagram, the person represents the physique of 95 percent of relatively large American males; the seat is in the last adjustable position of the forward and backward adjustments; the space for the hands is on the horizontal plane 9 inches above point H).

KEY: (1) Low point H, dimensions of axial line from point H, 100 millimeters
(2) Dimensions from operator, inch
(3) Dimensions of axial line from point H, inch
(4) Dimensions from operator, 100 millimeters
(5) Axial line of point H
(6) Largest
(7) Best

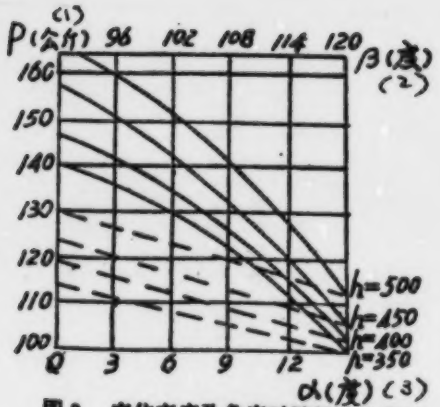

图 8 座位高度及角度对踏板力的影响

Diagram 8 The effect of the height of the seat and the angle upon the force applied to the pedals

KEY: (1) Kilogram
(2) Degree
(3) Degree

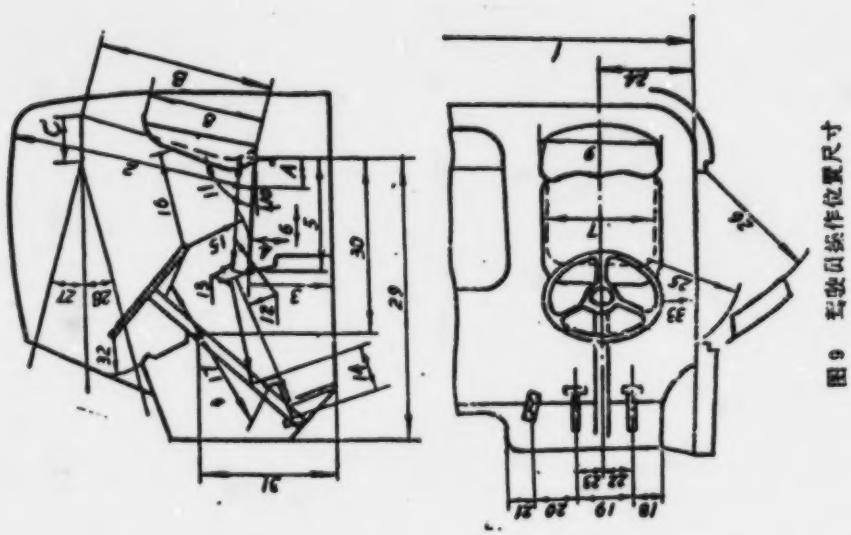

图 9 驾驶员操作位置尺寸

Diagram 9 Dimensions of the driver's operating position

The distance between the floor and the seat and the angle of inclination between the seat and the back of the seat affect the force applied to the pedals.

In Diagram 8: h is the height of the seat cushion from the floor; α is the angle between the seat cushion and the horizontal; β is the angle between the seat cushion and the back of the seat; p is the force that can be applied to the pedals.

We know from Diagram 8: to increase the force applied to the pedals, the seat should be higher while the angle of inclination between the seat cushion and the back should be small.

Visibility is determined by the position, height of the seat and the angle of inclination between the seat cushion and the back should be small.

Visibility is determined by the position, height of the seat and the angle of inclination between the seat cushion and the back of the seat, the dimensions of the front windshield, its shape and its arrangement, the structure of the frame, the hood and the shape and height of the wing panel.

A wide view not only facilitates the driver to observe the road surface, cars, pedestrians and traffic signals, it also improves safety, makes the driver feel comfortable and relaxed and reduces fatigue.

3. Arrangement of the Dimensions of the Operating Position of the Driver

The arrangement of the dimensions of the operating position of the driver is based on the effort to guarantee that the driver can operate normally and can have a rational space. The dimensions of the human body and the range of activity are the basic references for arranging the dimensions of the operating position of the driver.

Diagram 9 marks the items that are ordinarily controlled by the dimensions of interior arrangement of the driver's cab.

Table 5 lists the "recommended values" for the items marked in Diagram 9 according to the human physical dimensions of our nation's people.

To our comrades engaged in designing automobiles, some are familiar to us and they will not be introduced here. The following describes the methods of marking and determining some numerical values and some problems that have been easily overlooked in past designs:

(1) Determination of numerical values

The most fundamental references for determining numberical values are the human physical dimensions of our nation's people. Each dimension in Diagram 9 is based on the "average value" $\gamma \pm 1.645$ times the "standard deviation" σ of the dimension of the corresponding part of the human body.

This means, the dimensions thus obtained coincide with the dimensions of 90 percent of the people in our nation. To the driver, the dimensions coincide 95 percent (because in our nation at present, people shorter than 1,550 millimeters are not allowed to obtain a driver's license). Therefore, the dimensions calculated by this method are unsuitable only for drivers taller than 1,820 millimeters. This is consistent with the physical bodies of the 5 percentage points (short people) and the 95 percentage points (tall persons) of physical measurements used in the United States.

(2) The scope of the numerical values and the method of marking

To suite the various different models of vehicles (flat nosed, long nosed, half protruding head, light vehicles, heavy vehicles....) and the overall arrangement, the numerical value of each dimension has been given a range.

表5

A 序号	B 项目	C 推荐值(毫米、度)	
1	驾驶室内部宽度	单人座不小于 850	(36)
		双人座不小于 1250	(37)
		三人座不小于 1700	(38)
2	座垫上表面至顶棚高	不小于 1000	(39)
3	座垫上表面至地板距离	370±70	
4	座椅上下最小调整范围	±35	
5	座垫深度	420±40	
6	座椅前后最小调整范围	±70	
7	座垫宽度	不小于 450	(39)
8	靠背高度	480±30	
9	靠背宽度	不小于 450	(39)
10	座垫角度（与水平面间）	2°～10°	
11	靠背与座垫夹角	90°～105°	
12	靠背下缘至油门踏板距离	900～1000	
13	靠背下缘至离合器、制动器踏板距离	800～900	
14	离合器、制动器踏板行程	不大于 200	(40)
15	方向盘至座垫上表面距离	不小于 180	(39)
16	方向盘至靠背距离	不小于 350	(39)
17	方向盘至离合器、制动器踏板距离	不小于 600	〃
18	离合器踏板中心至侧壁距离	不小于 80	〃
19	离合器踏板中心至制动器踏板中心距离	不小于 150	〃
20	制动器踏板中心至油门踏板中心距离	不小于 110	〃
21	油门踏板中心至最近障碍物距离	不小于 60	
22	离合器踏板中心至座椅中心面距离	50～150	
23	制动器踏板中心至座椅中心面距离，	50～150	
24	座椅中心面至车门后支柱内侧距离	360±30	
25	车门打开时，下部通道宽度	不小于 250	
26	车门打开时，上部通道宽度	不小于 650	
27	上视角	不小于 12°	

28	下视角	不小于 12°
29	靠背下缘至前围距离	不小于 1050
30	靠背下缘至仪表板距离	不小于 650
31	仪表板下缘至地板距离	不小于 550
32	方向盘到前面及下面障碍物最小距离	不小于 80
33	方向盘到侧面障碍物最小距离	不小于 100
34	方向盘中心与座椅中心面偏移量	不大于 40
35	方向盘平面与汽车对称平面之间夹角	90°±5°

Table 5

KEY:

A Order number
B Item
C Recommended values (millimeter, degree)

(1) Interior width of the driver's cab
(2) Height from top surface of seat cushion to roof
(3) Distance from top surface of seat cushion to floor
(4) Smallest upward and downward adjustable range of seat
(5) Depth of seat cushion
(6) Smallest forward and backward adjustable range of seat
(7) Width of seat cushion
(8) Height of seat back
(9) Width of seat back
(10) Angle of seat cushion (between the horizontal)
(11) Angle between seat cushion and seat back
(12) Distance from bottom edge of seat back to gas pedal
(13) Distance from bottom edge of seat back to clutch and brake pedals
(14) Distance of clutch and brake pedals from floor
(15) Distance from steering wheel to top surface of seat cushion
(16) Distance from steering wheel to seat back
(17) Distance from steering wheel to clutch and brake pedals
(18) Distance from center of clutch pedal to side wall
(19) Distance from center of clutch pedal to center of brake pedal
(20) Distance from center of brake pedal to center of gas pedal
(21) Distance from center of gas pedal to nearest obstacle
(22) Distance from center of clutch pedal to center surface of seat
(23) Distance from center of brake pedal to center surface of seat
(24) Distance from center surface of seat to inner wall of the rear support of the car door
(25) Width of bottom passage space when car door is open
(26) Width of top passage space when car door is open
(27) Upper angle of view
(28) Lower angle of view
(29) Distance from bottom edge of seat back to front panel
(30) Distance from bottom edge of seat back to dash board
(31) Distance from bottom edge of dash board to floor

(32) Smallest distance from steering wheel to obstacles in front and below
(33) Smallest distance from steering wheel to obstacles on the side
(34) Shift between the center of steering wheel and center surface of seat
(35) Angle between the plane of the steering wheel and the symmetric plane of the vehicle
(36) Single seat not smaller than 850
(37) Two-person seat not smaller than 1250
(38) Three-person seat not smaller than 1700
(39) Not smaller than
(40) Not larger than.

It can be seen from the "recommended values" listed in Table 5 that there are three situations:

(1) Dimensions of unidirectional limitations: These are the allowable values of the extreme limits demanded by the dimensions of the human body. If the dimensions surpass these values of extreme limits, sitting or operation will not be comfortable.

There are 22 items that belong to this type of dimensions (for example: items 1, 2, 7, 9 in Table 5.)

(2) Intermediate dimensions adding to or subtracting from the range of variation: These are the best values determined according to the dimensions of the human body with an allowable range of variations. This means, it is hoped that designs can follow intermediate dimensions.

There are 5 items belonging to this type of dimensions (for example, items 3, 5, 8, 24 in Table 5).

(3) A range of dimensions, i.e., for selection within this range while the dimensions do not greatly affect performance.

There are 7 items belonging to this type of dimensions (for example, items 10, 11, 12, 22 in Table 5).

(3) Explanation of some items

The position of the seat in Diagram 9 refers to the middle position.

Besides the dimensions of items 10, 11, all dimensions related to the seat cushion and the seat back are all measured when bearing a load (the weight of the human body is calculated at 65 kilograms). This can eliminate the effect of differences in rigidity of the seat.

(1) Dimensions of item 13 in Diagram 9: These are the distances measured from the bottom edge of the back of the seat over the front edge of the seat cushion to the clutch and the brake pedals. These dimensions used to be controlled as two dimensions (i.e., the distance from the bottom edge of

the back of the seat to the front end of the seat cushion, and the distance from the front end of the seat cushion to the pedal). In this way, it is possible to select the lower limit or the upper limit for both dimensions and thus causing the dimensions of item 13 to be too small or too large. In addition, in view of the dimensions of the human body (item 14, Table 2), the above dimensions belong to the dimensions of the "length of the outstretched lower limb." Therefore, controlling them as one dimension is favorable to guaranteeing that the foot pedal can be operated well.

(2) The dimensions of item 17 in Diagram 9: These are the dimensions from the steering wheel to the clutch and brake pedals. These dimensions used to be overlooked in past designs. In recent years, because of the attention paid to comfort in driving, the arrangement of the steering wheel is more slanted. If these dimensions are too small, then frequently the knee will hit the steering wheel when the leg is lifted from the foot pedal. Therefore, starting out from guaranteeing rational operation, these dimensions should be controlled.

(3) The dimensions of item 24 in Diagram 9: These are the distances from the center of the driver's seat to the inside of the back frame of the car door. These dimensions were frequently not controlled in past arrangement and design. They were formed by the positions of the steering wheel and the pedals. For light vehicles, these dimensions are frequently too small. When the left hand maneuvers the steering wheel, the elbow easily hits the inner panel of the car door. For trucks of medium tonnage or above, because the gear shift is frequently placed near the symmetric center of the longitudinal car length, these dimensions are too large. As a result, the dimensions of the space on one side of the driver are too large. This hinders looking back while backing up the vehicle. The space on the passenger's side is too crowded and the width of the interior of the driver's cab cannot be rationally utilized.

On the other hand, the unification of these dimensions also benefits standaridzation of the driver's seat. For example, most of the trucks of Western European nations have uniformly installed a suspended driver's seat.

The application of the dimensions of the human body of our nation in the design of vehicles covers a broad range. We have only presented a preliminary measurement and discussion from the point of view of the measurements of the human body and the range of activity of the hands and feet. There is still a lot of in-depth work to be done further.

Even so, we have provided representative measurements according to objective needs and have obtained basic data that can be used in designs. At the same time, we also tried to start out from the viewpoint of human physiology, comfort, maneuverability and safety to present a preliminary view of the dimensions of the operating position of truck drivers (now, the recommended dimensions in Table 5 have been officially approved as the ministerial standards of the First Ministry of Machine Building, the file number of the standards is "JB2667-80," and the standards will be implemented starting August 1, 1980). This has provided a basis of practical significance for overall arrangement, arrangement of the body of the vehicle and seat designs.
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LIFE SCIENCES

'RENMIN RIBAO' ON TRADITIONAL CHINESE MEDICINE

HK140755 Beijing RENMIN RIBAO in Chinese 8 Jul 82 p 3

[Article by Cui Yueli [1508 2588 3680], minister of public health: "We Should Make Achievements in the Work of Traditional Chinese Medicine"]

[Text] Chinese medicine and pharmacology is a great treasure-house. It is a summation of the experiences of the Chinese people in fighting against diseases. It has a complete theoretical system and rich practical experiences. Its theoretical crux is an organic conception of the human body and dialectical treatment. The reason why traditional Chinese medicine has unlimited vitality is because it can really cure country's medical sciences.

Since the founding of new China, the CCP Central Committee and the old veteran proletarian revolutionaries including Mao Zedong and Zhou Enlai have attached great importance to and have been concerned about traditional Chinese medicine work. As a result, principles and policies on integrating traditional Chinese medicine with Western medicine and inheriting and carrying forward the motherland's medicine and pharmacology were formulated. Chinese medicine and pharmacology were seriously sabotaged during the 10 years of upheaval. The CCP Central Committee has reiterated the party's policy on traditional Chinese medicine since the Third Plenary Session. By means of turning chaos into order, the Public Health Ministry has eradicated "leftist" influences and formulated the principle that "Chinese medicine, Western medicine and integrated Chinese and Western medicine must all be developed and must coexist for a long time to come." In addition, various measures have been adopted to restore, rectify and develop traditional Chinese medicine. At present, the number of hospitals of traditional Chinese medicine throughout the country has increased from 171 in 1976 to 753, more than 8,000 general hospitals at and above county level have set up a department of traditional Chinese medicine and the number of beds set aside for traditional Chinese medicine patients has increased from 15,000 to 57,000. Higher education in traditional Chinese medicine and research in Chinese medicine have also been developed. There are now 22 colleges of traditional Chinese medicine, 1 college of Nei Monggol nationality medicine and some departments of Chinese medicine in certain institutes of Western medicine. The number of academies of traditional Chinese medicine and pharmacology has been increased to 43 and the traditional Chinese medicine research bases in Shaanxi, Hubei and Liaoning are under construction. The national

traditional Chinese medicine contingent has been enlarged from 230,000 people in 1976 to 290,000. Traditional Chinese medicine work has achieved a turn for the better. However, traditional Chinese medicine is still far from fulfilling the objective demands both in quantity and quality.

It is necessary to grasp two major questions in developing traditional Chinese medicine. The first one is to unswervingly implement the party's policy on traditional Chinese medicine; and the other is to maintain and carry forward the characteristics of Chinese medicine in the Chinese medical organs.

As far as implementing the policy of Chinese medicine is concerned, it is of primary importance to further eradicate "leftist" influences. "Leftist" influences have been very serious for a long time in our public health system. Since the third plenary session, although "leftist" influences have basically been overcome in the guiding ideology, we still have to make more efforts and need a relatively long time in order to correct "leftist" mistakes in actual practice. In the past, we obtained great achievements in integrating traditional Chinese with Western medicine and certain comrades have made great contributions to the study of integrated traditional Chinese and Western medicine. However, we have also seen cases in which new medical schools were rashly set up regardless of the circumstances and everybody was forced to learn traditional Chinese medicine, and so forth. Superficially, it seems that great importance has been attached to traditional Chinese medicine, but in fact, none are conscientiously studying Chinese medicine. As a result, people have only become familiar with certain prescriptions but know nothing about the theory of traditional Chinese medicine. The number of veteran traditional Chinese doctors is gradually decreasing and the young ones fail to keep up with them. Such a situation should be changed.

When stressing the implementation of the policy on traditional Chinese medicine, we do not imply, in any sense, despising and discriminating against Western medicine and integrated Chinese and Western medicine. Integrating both Chinese medicine and Western medicine is a principle which we have been consistently upholding. Chinese and Western doctors must learn from each other and encourage each other. This principle was advocated in the past, is being advocated now and will be advocated in the future. We must conscientiously implement the principle of integrating Chinese medicine with Western medicine. However, the crux of the question is in what position has traditional Chinese medicine been placed by the public health and administrative departments. We must explicitly point out that it is wrong for people to think that Chinese medicine is still not scientific and despise and discriminate against Chinese medicine, to only verbally support but actually discriminate against it or take a laissez-faire attitude toward it.

Currently, an outstanding question in Chinese medical treatment, teaching and scientific research is how to maintain and carry forward the characteristics of Chinese medicine. Chinese medicine has its own characteristics in diagnosis, treatment, emergency treatment, application of medicine, nursing and so forth. Chinese medicine which deviates from these characteristics will not be considered as Chinese medicine. If the basic theories of Chinese medicine

such as the five elements, the internal organs and the main and collateral channels, pathogencyand pathogenesis, the four methods of diagnosis and the eight principal syndromes, differentiation of pathological conditions and treatment in accordance with the eight principal syndromes, the principles and methods of treatment, and so forth are discarded, leaving only the simple prescriptions, Chinese medicine and pharmacology will nearly be totally discarded. Thus, the present urgent task is to solve the problem of maintaining and carrying forward the characteristics of traditional Chinese medicine. The hospitals of traditional Chinese medicine must practice by using Chinese medical treatment, prescriptions and differentiation of pathological conditions. Otherwise, it is meaningless to run hospitals of traditional Chinese medicine. As the name must match the reality, the hospitals of traditional Chinese medicine must really achieve this point. However, there are other kinds of work to be done and the crux is the question of the relationship between Chinese medicine and Western medicine. In order to handle well this relationship, it is necessary to carry out meticulous ideological work and organizational work. We must make rational arrangements for Chinese and Western medical personnel, enabling them to play their role and give full play to their enthusiasm.

Some people say that the Chinese medical organs' advocation of maintaining and carrying forward the characteristics of Chinese medicine, taking the Chinese medical theory as the guiding principles and promoting a "pure Chinese medical field," means "separating from Western medicine and going different ways." This is in fact an erroneous view. There is no such thing as pure things in the world. All sciences are, in the course of development, learning from each other, permeating each other and supplementing each other. Neither Chinese nor Western medicine is perfect and flawless, and they must both be developed in the course of incessantly learning new things. When we say maintaining and carrying forward the characteristics of Chinese medicine, we mean that we should restore and develop the characteristics of Chinese medicine in diagnosis, treatment, emergency treatment, application of medicaments, nursing, keeping medical records, bed management and so on. We must also improve the effectiveness of treatment and incessantly develop, perfect and improve in a planned way the professional standard of traditional Chinese medicine. In the course of developing traditional Chinese medicine and pharmacology, we must humbly learn and make use of modern science and technology, make use of modern scientific equipment, study the fundamental theory of traditional Chinese medicine and improve our own diagnosis and treatment methods. Although traditional Chinese medicine and pharmacology have a high effectiveness of treatment, some of them still cannot be explained by modern natural sciences. We believe that in the wake of the development of science and technology, we will improve our understanding and many questions in Chinese medicine which have never been understood will gradually be understood.

In order to solve the problem of personnel and equipment shortages, we must actively develop education in traditional Chinese medicine, practically run well academies of traditional Chinese medicine, colleges of traditional Chinese medicine and pharmacology, colleges of acupuncture and schools of

Chinese medical nursing, and attach great importance to the cultivation of Chinese medical specialists. In areas where demand for Chinese medical treatment is greater than supply, the colleges of Chinese medicine can help doctors to train apprentices in an organized and planned way. The academies of Chinese medicine are bases for carrying forward and developing traditional Chinese medicine and pharmacology and cultivating advanced Chinese medical personnel who have all-round development in their integrity, intellectual mind and physical state and who are both red and professional. In order to train qualified doctors of Chinese medicine, we must carry out education in accordance with the theoretical system of Chinese medicine. We must, on the basis of mastering the theory and treatment methods of traditional Chinese medicine, appropriately learn some Western medical knowledge in order to better carry forward and develop Chinese medicine and pharmacology. But none of this means that we train doctors who are both Chinese and Western medical specialists. The academies of Chinese medicine must strengthen the contingent of teachers and the building of clinical teaching bases. We must make clear that the subordinate hospitals of colleges of traditional Chinese medicine are hospitals of traditional Chinese medicine and not hospitals of integrated Chinese and Western medicine. All personnel must carry out work focusing on carrying forward and developing traditional Chinese medicine and pharmacology. While promoting education in traditional Chinese medicine and pharmacology and training of apprentice, we must also encourage people to learn by themselves. Where conditions permit, localities can open up schools of acupuncture, massage and bonesetting.

While we streamline government structure in the future, the organs in charge of Chinese medical management of the public health and administrative departments cannot be weakened but must be strengthened. Strengthening does not merely mean increasing the number of cadres, but demands a concise number of competent organs and leadership groups and personnel who fervently love Chinese medicine, uphold the party's policy on traditional Chinese medicine and who can carry out investigations, supervise inspections and solve problems. Thus, the overall implementation of the policy on traditional Chinese medicine will be ensured as far as organization is concerned. We must gradually increase the proportion of funds set aside for Chinese medicine. Special state subsidies for Chinese medicine must be really implemented and should not be used for other purposes.

There are still many problems in traditional Chinese medical work and these should be studied and gradually solved. These problems include Chinese medicinal herbs, scientific research in Chinese medicine and pharmacology, systematization of ancient books on Chinese medicine, nationatity medicine and medicinal herbs and so on. We must pay particular attention to integration of Chinese and Western medicine. In the past, general hospitals at all levels throughout the country and hospitals of traditional Chinese medicine have done an enormous amount of work in integrated Chinese and Western medical studies. However, most hospitals have only carried out fundamental work which needs to be further summed up in order to consolidate and develop the achievements. The Ministry of Public Health is now carrying out investigations and is making preparations for the convention of a work meeting. In short, although there are many problems, we can gradually do a good job of work in traditional Chinese medicine by seriously implementing the policy on traditional Chinese medicine and maintaining and carrying forward the characteristics of Chinese medicine.

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PUBLICATIONS

PREFACE TO COLLECTED PAPERS (EXCERPTS) OF THE SIXTH NATIONAL LASER TECHNOLOGY CONFERENCE

Shanghai JIGUANG [LASER JOURNAL] in Chinese Vol 9 n. 5, May 82 Preface

[Text] The Sixth National Laser Technology Conference, jointly sponsored by the China Optics Society and the China Electronics Society, was held in Anhui in May 1982.

By 31 Dec 1981, the conference's preparation group received a total of 460 papers (excerpts.) After they were studied twice by the preparation group, 130 papers were chosen to be delivered at the conference. Of these, 27 papers were on laser physics, 51 papers on laser devices, 30 papers on experimental technology and component materials, and 22 papers on applications and other aspects. The conference's preparation group requested the editorial department of the magazine Laser to edit and compile the aforementioned papers (excerpts) into a volume of collected papers. Due to the time limit on submission of papers, the newest research advances just before the conference convened, were not included in these papers (excerpts.) Moreover, due to the rush of editing, parts of the language and contents may be inavoidably inappropriate. Sympathetic understanding of the authors and readers are hereby implored. The papers delivered at the conference are used as the bases for all the information included in all the papers [in this volume.] The authors have the right to resubmit their papers for publication in related journals.

The conference's preparation group wish to express thanks to the editorial department of the Laser magazine for the great assistance rendered.

The Sixth National Laser Technology Conference Preparation Group
19 February 1982

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A $LiNbO_3$ (with Rich Li) Optical Parametric Oscillator Pumped by 1.06 μm Laser Light.....Wang Changshan [3769 7022 1472] and Lu Shiping [7627 1102 1627], both of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (42)

Nd:YAG Regenerated Amplifiers.....Liu Jiabin [0491 1367 1755] and Yu Lianshan [0060 6647 1472], both of the North China Institute of Opto-electronics (43)

Pulsed Multichannel Ruby Amplifier with a Telescope Cavity .....Yang Yimin [2799 6654 3046], Lu Qihua [7120 0366 5478] and Xu Lianke [1776 6647 4430], all of the North China Institute of Opto-electronics (43)

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Generation of UV ps High Power Laser Pulses.....Teng Yonglu [3326 3057 4389], Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (45)

Mode Locking Range of Passively Mode-locked Glass Lasers Pumped by Sinusoidal Light.....Zhang Limin [1728 4539 2404] and Wu Hongxing [0702 7703 5281], both of the University of Science and Technology of China; Fan Dianyuan [5400 3329 0337], Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (46)

Actively-passively Mode-locked Repetition Rate Nd^{3+}:YAG Lasers with High Stability.....Group of Ultra-short Pulses, Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (47)

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Acousto-optic Active Mode Locking of Ar Ion Lasers and Ultra-short Pulsed, Tunable CW Dye Lasers Pumped Synchronously..... Liu Yupu [0491 3768 3877], Zhang Yinghua [1728 1758 5478] and Zhang Guoxuan [1728 0948 6513], et al., all of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (49)

Research on the Output Characteristics of Synchronously Pumped Tunable Dye Lasers.....Lin Weizhu [2651 0143 2701], Wang Wanlun [3769 8001 0243] and Fang Xindong [2455 1800 2639], all of the Department of Physics, Zhongshan University (50)

Pulse Repetitive Tunable Dye Lasers of High Power, High Quality and Narrow Bandwidth.....Research Group of Tunable Lasers, Department of Physics, Jilin University; Institute of Atomic and Molecular Physics; Jilin Trial Production Factory of Optics and Fine Mechanics (51)

PS Pulsed Tunable Dye Laser with an Ultrashort Cavity..... Tang Guichen [0781 6311 3819] and Qiu Peixia [5941 0160 7209], both of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (52)

Two Types of CW Ring Lasers Using Dye for Mode-locking..... Group of PS Dye Lasers, Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (52)

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Study on the Luminescence Position of GaAlAs/GaAs DH Lasers .....Shan Zhengguo [0830 2182 0948], Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (57)

Analysis of Dielectric-dielectric-conductor Plate Light Waveguide and the Study on GaAs Electro-optic Waveguide Modulation.....Jia Youhan [6328 2589 3211], et al., all of the Institute No 209, Fifth Ministry of Machine Building (58)

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Room Temperature TEA CO Lasers.....Wu Wenzhou [0702 2429 3166], Xu Shaoji [1776 4801 4921] and Wang Huasheng [3769 5478 0524], et al., all of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (59)

Frequency Selected N_2O Lasers.....Guo Zengxin [6753 1073 2946], Zhang Hansheng [1728 3211 3932] and Lu Mingchang [7120 2494 2490], all of the Department of Physics, Huadong Teachers University (60)

Far IR D_2O and CH_3F Lasers Pumped by Pulsed Light.....Pan Chengzhi [3382 2110 1807], Liu Xiuyun [0491 4423 0061] and Tang Guiping [0781 2710 1627], et al., all of the Beijing Institute of Vacuum Electronic Devices (61)

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Molecular Nitrogen Lasers with an Output up to 24 mJ..... Excimer Laser Group, Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (63)

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Measurement Methods for Impulse of Targets under Intense Laser Action.....Wang Chunkui [3769 2504 1145] and Fu Yushou [0265 5940 1108], both of the Institute of Mechanics, Chinese Academy of Sciences; Li Huining [2621 1920 1380], Beijing Designing Division for Electronic Engineering (72)

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Tunable Laser Crystal $BeAl_2O_4:Cr^{3+}$ Grown by the Czokralski Method.....Ma Xiaoshan [7456 4562 1472], Hou Yinchun [0186 0603 2504] and Wang Siting [3769 0934 0080], et al., all of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (74)

Preliminary Laser Test on $BeAl_2O_4:Cr^{3+}$ Crystals.....Zhang Shoudu [1728 1343 6757], Wu Guangzhao [0702 0342 3564] and Ma Xiaoshan [7456 4562 1472], et al., all of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (74)

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Experimental Study on a New Nonlinear Saturable Absorber--$LiFi:F_2^-$.....Zhang Guifen [1728 6311 5358], Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (76)

Structure and Spectra of Q-switched Laser Dyes in the Near Infrared Range.....Ma Chunrong [7456 2504 2837], Li Naiji [2621 6621 0679] and Li Jiaze [2621 1367 3419], et al., all of the Beijing Institute of Technology (77)

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Semiconductor Doping of Organic Colloidal Dopants by Laser Irradiation.....Du Yuancheng [2629 0337 2052], Sun Diechi [1327 6613 4654] and Zhao Yansheng [6392 5888 4141], et al., all of the Department of Physics, Fudan University (79)

Photoconductive Properties of Cr:GaAs under the Action of Ultrashort Pulses and Picosecond Opto-electronic Switches .....Zhu Xinming [2612 9515 6900], Chen Lanrong [7115 5695 2837] and Zhi Tingting [2388 1250 1250], all of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (80)

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Study on Elliptical Polarizing Light of IC Si Strips under Intense Laser Irradiation.....Li Yuanheng [2621 0337 1854], Institute of Mechanics, Chinese Academy of Sciences; Wang Zhenming [3769 2182 2494], Institute of Automatization, First Ministry of Machine Building (82)

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Continuously Adjustable Helium-refiller for Long-lifetime He-Cd Lasers.....Ye Zhonghua [5509 1813 5478], Zhang Xiangsu [1728 0686 5685] and Chen Congrong [7115 5115 2837], et al., all of the Laser Laboratory, Department of Physics, Fujian Teachers University (85)

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Progress of Satellite Laser Ranging in Shanghai Observatory .....Satellite Laser Ranging Research Group, Shanghai Observatory, Chinese Academy of Sciences (96)

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Two-dimensional Laser Doppler Velocimeter by Polarization Method.....Tang Kaiyuan [0781 7030 0337], Sun Yusheng [1327 1938 3932] and Fan Lijuan [5400 7787 1227], et al., all of the Shanghai Institute of Laser Technology (97)

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Photoelastic Simulation by Laser Holography of Stress Fields of Fuyun Region in Xinjiang.....Qian Ruihua [6929 3843 5478], Xie Weijiang [6200 5898 3068] and Hao Yuhong [6787 1342 4767], all of the Institute of Geology, National Bureau of Seismology (99)

Preliminary Application of Plane Holographic Photoelasticity to Seismology.....Liao Suqiong [1675 4290 8825], Wang Chunhua [3769 2504 5478] and Yang Guizhi [2799 2710 2655], all of the Institute of Geology, National Bureau of Seismology (99)

Frequency Spectrum Detection of Germ-carried Cells by an Array of Wedge-shaped and Ring-shaped Detectors.....Zhao Huanqing [6392 3562 0615], Chen Rungen [1478 3387 2704] and Du Yuancheng [2629 0337 2052], et al., all of the Laboratory for Laser Physics, Department of Physics, Fudan University (100)

Laser Photo-acoustic Detection and Its Application to Continuous Absorption Measurement of Water Vapor..... Wu Jihua [0702 7139 5478], Sun Fengyi [1327 7685 0308] and Pu Dasheng [3184 6671 3932],et al., all of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (101)

Micro-gas-flow Detection by Laser Photo-acoustic Technique .....Wang Lanping [3769 5695 5493], Hu Bin [5170 6333] and Zhang Hong [1728 4767], et al., all of the Department of Physics, Beijing University (102)

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Attenuation of Laser Radiation Propagating Through Atmosphere.....Wu Jihua [0702 7139 5478], Gong Zhiben [7895 4249 2609] and Tan Kun [6223 6924], et al., all of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (103)

Effect of Thermal Distortion on the Propagation of Collimated High Power Gaussian Laser Beams at 10.6 μm.....Gong Zhiben [7895 4249 2609], Gu Weiyu [7357 1983 3254] and Wang Dinghua [3769 1353 5478], et al., all of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (104)

Experimental Study of Nonlinear Thermal Distortion of High Power Laser Light.....Wang Dinghua [3769 1353 5478], Ke Zhenling [0344 6966 3781] and Wang Chao [3076 6389], et al., all of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (105)

Jittering and Spreading of Infrared Laser Light in Near-ground Atmosphere.....Song Zhengfang [1345 2973 2455], Han Shouchun [7281 1343 2504] and Ding Qiang [0002 1730], et al., all of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (106)

Laser Glittering in the Relatively Stable Propagation Layer Near the Sea Surface.....Le Shixiao [2867 2514 2556], Chengdu Institute of Telecommunication Engineering (107)

Model White Sample Cell with 10 Meter Long Multi-optical Path Length.....Lin Yuanqi [2651 6678 7871], Guo Zengxin [6753 1073 2946] and Wang Wanchun [3769 8001 2504], et al., all of Research Group No 911, Department of Physics, Huadong Teachers University (107)

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CSO: 4008/191

AUTHOR: CHENG Qingguo [4453 1987 0948]
JIN Dongcan [6855 2639 3503]
WU Liangming [0702 0081 2494]
et al.

ORG: None

TITLE: "The Hongshui River Cable-stayed PC Railway Bridge--Its Design, Construction and Tests"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese No 2, 1982 p 18

TEXT OF ENGLISH ABSTRACT: The Hongshui River cable-stayed PC bridge at Laibin, the Hunan-Guangxi Railway Line, is the first railway bridge of that type ever built in China. The main part is a three-span (48 + 96 + 48 m) continuous box girder of uniform depth (3.2 m), rigidly fixed with the pylons. The stay-cable system consists of two pairs of parallel cable planes, each composed of three pairs of inclined cable sets in harp arrangement. The anchorages are designed for possible post replacement or tension adjustment of cables when in service. In the project, special measures are taken for corrosion protection of cables and, in addition, the techniques such as PTFE pot bearings, the high performance retarding-plasticizing agent FDN(R) compound, Model TD-100 universal tensioning jacks, and grooved wedge type composite anchorage, etc., are used.

[Continuation of TUMU GONGCHENG XUEBAO No 2, 1982 p 18]

In this paper, a brief description of the structural features, desing principles and construction methods of the bridge is given; the model investigations, including 1:30 bridge model, 1:4 joint model and wind tunnel test secretion model, and the rating tests for both static and dynamic loading conditions are outlined.

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AUTHOR: XU Bangdong [1776 6721 2767]

ORG: Northwest Research Institute, Ministry of Railways Academy of Scientific Research

TITLE: "Landslide Control of Railway Lines in China"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese No 2, Jun 82 pp 77-84

ABSTRACT: Based upon the practice of taking care of landslide damages to railroad beds of many years, this paper proceeds to summarize the experience. Various phenonmena and various stages of development of landslides are classified and described. Some cases, such as the Kunhe Railway constructed in 1911, the Guikun Line at Nuokui Station, and the Baocheng Line at Dingjiahe have been constantly threatened by landslides. Photos are included in the paper to illustrate these conditions. Finally, some cases of successful landslide control are related. The paper also mentions the Fourth Landslide Control Experience Exchange Conference held in Lanzhou in 1973 when the landslide control techniques in China and in foreign countries were summarized and compared. In reality, the various measures used in foreign countries have all been tried in China. Of these measures, the rigid slide-resistant engineering measures are applied more frequently; electoosmotic drainage, chemical grouting, baking, etc. landslide control techniques have rarely been applied, however.

6248
CSO: 4009/361

AUTHOR: WANG Bingnan [3769 3521 0589]

ORG: Electrical Engineering Institute, Chinese Academy of Sciences

TITLE: "Faraday MHD Generator--The Equivalent Circuit and Its Cutset Solution"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY] in Chinese No 3, 1982 pp 41-46

TEXT OF ENGLISH ABSTRACT: A four-terminal network of Faraday's MHD element generator and the complex equivalent circuit with it given here are of greater generality than the existing ones. The cutset method can be used for solving circuit problems in the MHD generator under various loading conditions.

AUTHOR: LI Xixiong [2621 6932 7160]

ORG: Huazhong University of Science and Technology

TITLE: "Reliability and Stability of Integrated Digital Control System"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY] in Chinese No 3, 1982 pp 47-56

TEXT OF ENGLISH ABSTRACT: The IC element processing, the circuit state to be chained and interlocked, the potential-controlled information to be pulsed and the intrusion prevention and suppression of noise are investigated in order that the reliability and stability of the integrated digital control system can be duly improved.

[illegible]17
CSO: 4009/362

AUTHOR: None

ORG: Research Laboratory of High Temperature Gas Dynamics and Plasma Technology, Institute of Mechanics, Chinese Academy of Sciences

TITLE: "The Effects of a Transverse Magnetic Field on a Non-equilibrium Ionized High-velocity Gas Stream"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 3, 1982 pp 291-296

TEXT OF ENGLISH ABSTRACT: The effects on a non-equilibrium, ionized, high-velocity gas stream of a strong magnetic field normal to the stream are studied by experiments and analysis. The electron density in the test stream of a small arc tunnel was reduced by an order of magnitude by this method, indicating that this is one way to partially control the electrical parameters in a low-density arc-heated wind tunnel.

AUTHOR: TANG Fulin [0781 4395 2651]
XUE Minglun [5641 2494 0243]

ORG: Both of the Institute of Mechanics, Chinese Academy of Sciences

TITLE: "The MHD Equilibrium and Instability of Infinitely Long Belt-pinch"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 3, 1982 pp 302-307

TEXT OF ENGLISH ABSTRACT: In this paper the highly elongated belt-pinch is taken as an infinitely long tube under the conditions that both the poloidal magnetic flux and current are conservative in plasma. The toloidal plasma current density is described by $j_\varphi = 2\pi ra + \frac{\mu}{4\pi r}b$. Equilibrium relations are derived analytically. For given m the instability growth rate $\bar{\omega}$ calculations are performed, and the effect of the poloidal beta β_p is considered when the plasma is surrounded by a vacuum. When $\bar{k}$ is varied at a fixed m, the growth rate runs through a maximum. The maximum growth rate increased with increasing m and the poloidal beta β_p has little influence on the maximum growth rate. The order of the calculated ω is 10^5 1/sec, which is consistent with experimental findings.

9717
CSO: 4009/368

AUTHOR: None

ORG: Department of Water Conservancy Engineering

TITLE: "Research on the Problem of Silt in Huanghe"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese Vol 22 No 2, May 82 p 30

ABSTRACT: For a long time, the teachers and students of the Department of Water Conservancy of Qinghua University have cooperated with the Huanghe Water Conservancy Committee in a series of research studies on controlling Huanghe. In 1969, the department participated in the research and designing work of the Sanmenxia Reconstruction project. In 1979, on the basis of the more than a decade of work, the paper, "Opinions Concerning the Control of Middle and Lower Reaches of Huanghe" was proposed. Related agencies have paid attention to these opinions and confirmed them. The key problem of Huanghe is silting and the silt mainly damages the lower reaches while the origin of the silt is the middle reaches. The silt built-up in the channel of the lower Huanghe is composed mainly of sand granules greater than 0.05 mm in diameter and this course sand comes largely from the 2 regions of from Hekoudian to the mouth of Wudinghe and the source of water at Baiyushan. The floodwater of these 2 regions often causes tremendous accumulation of sand in the lower reaches, according to analyses of 1952-60 of 103 floods, the average daily silt build-up reaches 3,000 tons coming from the 2 regions, amounting to 60 percent of the total accumulation in the lower reaches. According to statistics, about 80 percent of the coarse sand

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come from areas measuring 100 thousand km^2 and 60 percent of it from areas of 50 thousand km^2, where the modulus of erosion reaches 8000-10000 tons/km^2 a year. It is suggested that the State should invest a capital of 1 billion yuan to cooperate with the local masses to concentrate all capabilites on treating these areas of 50 thousand km^2 of the chief source of coarse sand, at an expenditure of 20 thousand yuan per km^2. A Silt Research Office was established by the department of the university in 1978 and in 1981, the establishment of a new silt experiment laboratory was proposed. Aside from studying the silt problem of Huanghe, the laboratory should also proceed with research on the basic theory of water flow of high sand content, a silt model experiment of the backwater regions of the Changjiang Gezhou Dam and the Changjiang Gaxia Engineering Project, and such subjects as long distance pipeline transport of slag and coal, etc. as well as train a group of graduate students.

AUTHOR: None

ORG: None

TITLE: "New Results of Scientific Research in 1981"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese Vol 22 No 2, May 82 p 112

ABSTRACT: In 1981, the university won 40 awards for scientific research in various fields, in addition to the publication of 982 papers. In the year, 49 scientific and technological products of the university were certified, approved, and put into application. These include the TF-2 graph generator, with a variance $\leq \pm 1\mu$. The Department of Chemical Engineering cooperated with Shandong Qilu Oil Refinery in producing some new designs to improve the rate of reclaimed heat and to reduce energy consumption. The Nuclear Energy Center of the university succeeded in developing the hollow cathode discharge ion plating technique. It has been used to produce batches of golden watch-cases for many watch manufacturers of the country. With the cooperation of related restaurants, the Department of Automation completed the "restaurant dining room management automation technique." The biomedical engineering research, the radio, and the electrical machinery departments also reported several accomplishments in the year 1981.

6248
CSO: 4009/345

AUTHOR: DING Huiliang [0002 1920 2733]
CHEN Wenpu [7115 2429 3184]
SUN Xianxue [1327 2009 1331]
WU Fang [2976 6078]

ORG: None

TITLE: "An Optimum Design of Fuselage Structure"

SOURCE: Wuchang GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 2, 1982 p 164

TEXT OF ENGLISH ABSTRACT: This paper briefly presents the application of the "improved" fully stressed design (FSD) method to fuselage structure design. In addition to the conventional stress and minimum gauge constraints, the component buckling constraints are also involved. When component buckling constraints are considered, the oscillation in stress-ratio redesign can be effectively damped by means of the "under relaxation" factor derived in this paper. In addition to the commonly used bars, panels and beams, some "dummy" and scalar elements are used to avoid the "ill condition" of idealized model of the complex fuselage structure.

The computer program is composed of some modules, so it is very easy to modify or extend for further development. There are also some options in the program,

[Continuation of GUTI LIXUE XUEBAO No 2, 1982 p 164]

including adjustments to the converged design and a final structural analysis, in order to make the results more reliable.

In the sample application to a fuselage structure, the design is basically converged after only five iterations. The converged design is satisfactory and is about 11 percent lighter than the initial one.

9717

AUTHOR: CHEN Zishu [7115 1311 1859]

ORG: None

TITLE: "The Second National Conference on Nonlinear Vibration Held in Huangshan"

SOURCE: Wuchang GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 2, May 82 pp 311-312

ABSTRACT: China's Second Nonlinear Vibration Scientific Exchange Conference was held in Huangshan, Anhui Province on 10-17 Nov 81. Participants included mathematicians, physicists specializing in mechanics, etc. representing 75 institutions of higher education and scientific research; there were 108 delegates. Compared with the first conference and judging from the composition of the delegates, a team of scientists specializing in nonlinear vibration theory appears to be basically established in China. The conference proceeded in 2 stages: The first stage was devoted to reading and exchanging 67 papers, the contents of which covered the analytical method, the qualitative method, parameter vibration, structural vibration, vibration machines, rotor dynamics, electrical power transmission, transport machines, etc. The second stage was devoted to special subject reports; 12 special subject reports were delivered, covering such subjects as random vibration in a nonlinear system, etc. All delegates agreed that it is absolutely necessary to have this type of conference at least once every 2 years. It was proposed that the next conference should be held in the autumn of 1983; Tianjin University was asked to be responsible for its preparation.

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CSO: 4009/366 END

JPRS 81579

19 August 1982

China Report

SCIENCE AND TECHNOLOGY

No. 170

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CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 170

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APPLIED SCIENCES

WIRETAPPING TECHNIQUES, EAVESDROPPING DEVICES DISCUSSED

Beijing YIQI YU WEILAI [INSTRUMENTATION AND THE FUTURE] in Chinese No 5, 1982 p 5

[Article by Yang Baogen [2799 1405 2704]: "The Walls Have Ears--On Eavesdropping Techniques"]

[Text] When you mention eavesdropping, people may think of the "Watergate Affair" which occurred in the United States in 1972. This wasn't something new that Nixon thought up. The use of eavesdropping to steal political, military and economic intelligence, to carry out criminal investigations, or even to spy on private lives is an open secret in the Western world today.

Eavesdropping has become the practice in political and diplomatic struggle; it has a long history. But eavesdropping techniques, particularly instrument eavesdropping, has a history of only 30-40 years. Shortly before World War II, in the office of a senior officer of the U.S. Pacific Fleet, a wire recorder was used for the first time. This 3-foot high, 50-pound telegraphone, invented by the Swede, Poulsen, in 1898, was used to listen in on sailor's conversations. After World War II, eavesdropping equipment underwent many improvements, achieving qualitative leaps, through wireless electricity, transistors, integrated circuits, and large-scale integrated circuits, and a wide range of equipment was developed, leading to today's true breakthroughs in electronic surveillance.

Modern eavesdropping is divided into direct eavesdropping and indirect eavesdropping. In direct eavesdropping, a wire-connected receiver and microphone are used. Because this eavesdropping equipment uses a wire connection, it is easily exposed. One time a U.S. reporter walking in the park across from the White House stumbled over a wire and discovered a wiretap microphone under a bench. In such eavesdropping equipment, after several later improvements, the microphone was placed in a tiny wireless transmitter so that the eavesdropper could listen in by wireless receiver hidden tens of meters away. This kind of eavesdropping can only work with a wireless transmitter battery voltage of sufficient duration, for when the battery is dead, it is of no use.

There are many methods of indirect eavesdropping; the most commonly used are the following. In laser eavesdropping, a green or purple color laser, which

does not attract attention, is beamed onto glass or an automobile reflector. When people talk, the sound causes the glass in the window or the reflectors to produce tiny vibrations, so that using the optical characteristics of the incident light or reflection, what the people are saying can be determined from the reflected beam.

In microwave eavesdropping, a resonator is hidden in an object such as a lampbase, wall, table, hollowed out equipment or souvenir in the room to be listened in on. When people talk, the resonator vibrates, the waves sent back from the resonator by microwave beams are compared with the incident waves, and the sound can be reproduced. The KGB used this method with a resonator placed in the U.S. embassy. It would both interfere with U.S. embassy monitoring equipment and provide eavesdropping capability. A bug was placed in the emblem on the U.S. embassy and hung there for 7 years, by which eavesdropping on a great many secrets was achieved. After this was disclosed in May 1978, it created quite a scandal.

Miniaturized and microminiaturized listening equipment can be placed on a spider or a fly. One American company, in order to listen in on the board of directors of a competitor, placed a listening device on the back of a fly, and so that the vibration of the fly's wings would not influence listening in, the fly was given a drug so that when the fly reached its destination it died; thus conversations could be clearly heard within 5 meters. To be able to listen in at even greater distances, an intermediate automatic wireless reconnaissance station can be used to collect signals which are scattered in the vicinity. This is called the mother-child eavesdropping method. The U.S. CIA has drawn up plans for a "pyramid" which uses three synchronized satellites to listen in on spy stations throughout the world and naturally includes this listening device.

Advanced amplifiers can make very weak signals millions of times stronger. If a miniature microphone is placed in the bore of a "shotgun," that is, in the focal point of the dish, it can listen in on the direction in which the "shotgun" is pointed. Such a highly sensitive listening device is generally used in automobiles of diplomatic personnel. Using this listening device, one can listen in on conversations in a building across the street over the noise of the busy street.

Lip-reading is another method of listening in. If you can record the oral expressions of talkers using a motion picture camera, you can use lip-reading analysis to determine the content of the conversation.

Another method of listening in is telephone eavesdropping. In foreign countries, the police bureau or telephone bureau has a secret telephone eavesdropping room where it can use secret telephone extensions to monitor telephone conversations at any time and even record them. In addition, the telephone itself can be turned into a tool for listening in on conversations, for in addition to placing a listening device inside the telephone, the use of a new listening device called a harmonica is even more dangerous. This device uses existing telephone lines to listen in. When the United States first used this, a harmonica tone was used to activate it, so it came to be called a harmonica listening-in device.

Although the constitutions in capitalist countries stipulate clearly that eavesdropping is illegal, the constitutions do not prohibit the sale of listening devices. Thus in many countries sophisticated and ingenious listening devices are openly sold on the market. To listen in on the financial secrets of a certain company, a Japanese bank put a listening device in the false teeth of the company's chief accountant and so achieved its aim of obtaining secrets. In Cologne, West Germany, the police seized over 200 miniature listening devices and 50,000 parts in a jewelry store.

If there's a spear, there must be a shield. The development of listening techniques must lead to research and development of counter listening techniques. The secret struggle of listening and counterlistening will become increasingly fierce.

The complexity of international struggle awakens us to the fact that we cannot lower our guard but must maintain state secrets.

Fig. 1. Several listening devices.

(From left to right) Telephone wiretap recorder, Miniature listening device, Miniature transmitter.

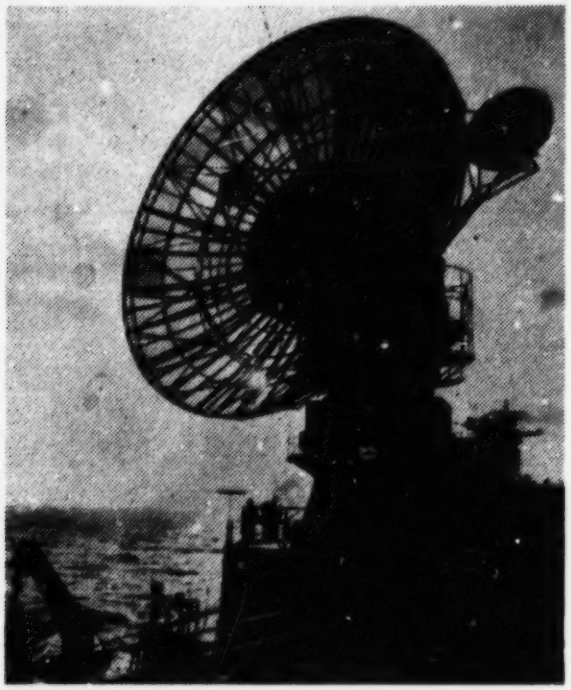
8226
CSO: 4008/190

PERSONNEL ABOARD TRACKING VESSEL PREPARE FOR UPCOMING SPACE SHOT

Beijing RENMIN RIBAO in Chinese 25 Jul 82 p 1

[Photograph and Caption]

[Text] National defense science and technology personnel are hard at work to accelerate the modernization of China's armed forces. Here, they are conducting rocket test flight experiments aboard a Chinese-designed and built large range instrumentation vessel.



CSO: 4008/211

'NEW SCIENCE' ANALYSES OPTIMUM COORDINATION SYSTEMS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81 pp 17-20

[Article by Tu Xuyan [3205 1645 1750] of the Automation Institute, Chinese Academy of Sciences: "On 'Coordination'"]

[Text] Coordination is a common problem in the three major fields of engineering technology, social economy and biological ecology. Coordination among local subsystems in a large system means not only to achieve mutual constraint but also mutual support and promotion and to achieve the optimization of the entire system. It is therefore highly significant to develop the study of coordination and explore the principles of coordination in order to improve the level of scientific management and speed up the construction of the four modernizations.

I. Coordination in Engineering Control

As science and technology progress, the process of production is becoming more and more complex. As automation progresses from a single machine to a group of machines, control theory also develops from a single variable theory to a multiple variable theory. Coordination in engineering control is the study of the principles and methods of coordination in multiple variable control systems.

In a multiple variable system, even if each individual variable is controlled to operate reliably according to its purpose and requirement, it is still a big question whether the multiple variable system composed of these individual variables can operate normally. It often happens that the entire system cannot function normally because of the interaction between variables. For example, in a multiple variable controlled boiler engine system, even if individual variables such as temperature, pressure, flow rate, liquid level and revolution speed are properly controlled, there may still be many problems in the operation of the entire system. Temperature adjustment affects pressure, flow rate adjustment disturbs liquid level, and so on. It is therefore necessary to look at the overall situation and correctly handle the coupling between the thermodynamic, fluid and mechanical structures in the control process.

In order to eliminate the mutual interaction between the variables due to coupling, people have proposed the "autonomous adjustment" principle of a multivariable control system, also known as the control principle of no interaction. In this principle, the "coupling" between the controllers is used to completely cancel the "coupling' between the controlled variables, thereby making the single variable control process independent of each other and resolving the multivariable control system into "autonomous" single variable control systems. Under certain circumstances, such "autonomous adjustment" has been proven effective.

In many cases, however, the requirement is not an "autonomy" of various control processes but a "coordinated relationship" between various control processes. In the production process of chemical engineering and pharmaceutical preparation, for example, a certain ratio must be maintained in the composition. In an electrical power system, power should be distributed according to load. In continuous steel rolling and paper making by the parts, the speed of the various machines must be coordinated. Besides, coupling between the controlled variables is not always undesirable. In the attitude control system of an artificial earth satellite, the coupling effect is used to solve the rudder deflection angle measurement problem. Beneficial coupling may be used to improve system performance, simplify the control system, and reduce the production cost. If all couplings are eliminated, no matter whether they are beneficial or hazardous, the entire system will be complicated and the cost will go up. Certain strong couplings are very difficult to decouple, and the residual coupling may cause oscillation and lower the system performance. We therefore propose a "coordinated control" principle for multivariable control systems. It consists of the following: make use of or strengthen beneficial couplings, eliminate or decrease undesirable couplings, build up a coordinated relationship among the controllers, control the system according to deviation from coordination, coordinate the control process of variables, maintain the necessary coordination, accelerate the coordinated control process and achieve the overall optimization of the entire multivariable control system.

There are many ways to achieve coordinated control, for example:

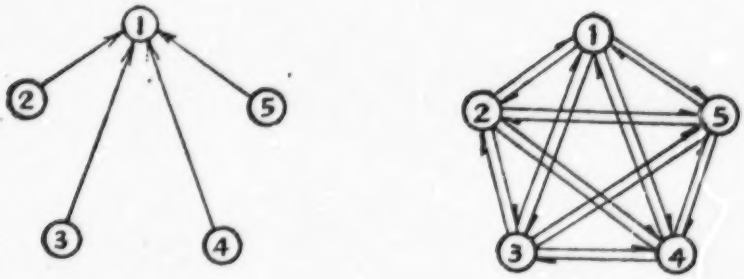
1. Lead Coordination.

In a multiple variable control process, one variable is made the leading variable and the other variables are controlled and coordinated on the basis of the leading variable. In leading coordination there is only unidirectional flow of coordination signal, as shown in Figure 1(a).

2. Self-coordination.

As shown in Figure 1(b), various variables lead each other and form a complete bidirectional flow of coordination signal. Based on a self-adjusted internal given quantity, coordinated control is carried out for all variables.

In actual practice, the method of coordinated control takes various forms and may be a combination or modification of the two proposals above.



1.a 1.b

Figure 1. Vector diagram of coordinated control signal.

II. "Resolution-Coordination" Method in Large-Scale System Theory

In large-scale systems which have a complex structure, generalized functions and numerous factors, the direct application of optimization control theory and management method in the hope of solving the dynamic optimization and static optimization of a large system in one stroke will not only involve a huge amount of analysis but is also very difficult to carry out technically. Therefore, a "resolution-coordination" method is developed for large systems.

Resolution--Resolution here refers to resolving a complex large system into simpler small systems. It includes objective resolution and model resolution. Either "actual resolution" or "nonactual resolution" may be used. On each small system, optimization control theory or management method may then be applied directly in solving its local optimization problem.

Coordination--On the basis of locally optimized small systems, mutual interaction and influence are taken into account and the overall optimization of the entire system is realized through coordinated control. Here one also has objective coordination and model coordination. Coordination principles such as "correlated equilibrium" and "correlated pre-estimate" are used and closed-loop feedback control is carried out based on deviation from coordination.

The "resolution-coordination" method solves the optimization problem of large systems in two steps. In the first step, the whole is broken up into parts, and in the second step, the parts are gathered into a whole. In this process, resolution and coordination reinforce each other and conflicts are unified.

To achieve an integrated automation of the production process, the "resolution-coordination" method may be used in solving the optimization problem of enterprise management and process control. In general, large systems are organized according to a "multilevel staged control' structure. Figure 2 shows a three-level staged control proposal. The third level (the lowest level) consists of local controllers, and local automation and optimization of small systems are solved. The second level (intermediate level) bridges the lowest and the highest levels and consists of various stage controllers. The second level accepts coordination control from the upper level and coordinately controls the lower level. The first level (the highest level) is the coordination

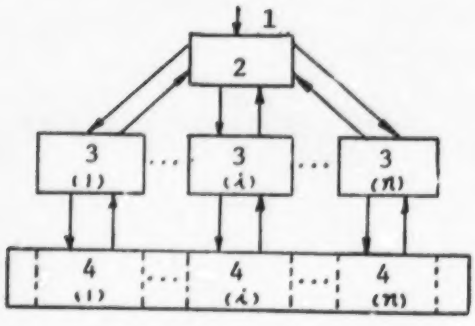


Figure 2. Multilevel staged control plan.

Key:
1. Overall mission
2. Coordinator
3. Local controller
4. Subprocess

controller. Based on the overall objective and mission of the large system, the first level carries out coordinated control of the lower levels and accomplishes the automation and optimization of the large system.

This multilevel control has the advantages of both "centralized" control and "distributed" control. It can conduct coordination effectively with a high system reliability, and the scheme can be easily carried out with a microprocessor network. For this reason, it is an organization plan widely used in large systems.

III. "Planned Coordination" Technique (PERT) in Scientific Research Management

In large-scale research and development tasks, an operational procedure based on specific goals, timetable and undertaking departments is drawn up and a network model is established. The "planned coordination" is an organization management technique that makes use of the network model (project flow diagram), deploys the manpower, material and financial resources rationally and effectively, and accomplishes the mission in the best and fastest way.

The procedure of planned coordination is as follows:

1. Based on the overall mission, objective and proposal, the entire process from job assignment to mission accomplishment is divided up. Specific tasks of each operational procedure are determined, "items" at the beginning and end of each operational procedure are marked, anticipated time of completion of each procedure is estimated, and a "project flow diagram" is drawn up to depict the entire process.

2. Based on the project flow diagram, the earliest anticipated starting time, the latest permissible completion time and the relaxation time of each event are calculated.

3. The "emergency line" (or the "key line") that takes the longest time to complete the job is located and marked with double line. In Figure 3, this is (1)⟶(3)⟶(4)⟶(5)⟶(6)⟶(14).

4. Other nonemergency lines are adjusted and personnel, material and funds are rationally arranged, making sure the emergency line can be completed in time or ahead of schedule.

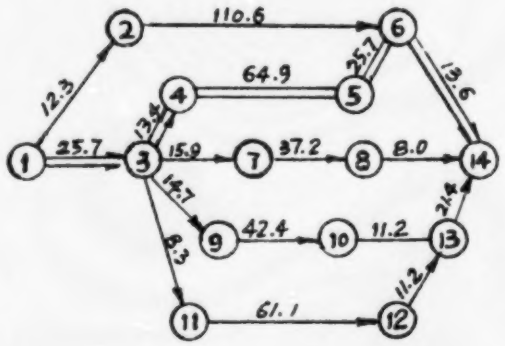


Figure 3. Project flow diagram.

5. The planned time of the task and its probability are calculated.

Even after the work actually begins, necessary coordination can be made frequently based on all the newest information in order to optimize the procedure and make the overall progress the fastest (time optimization) for the given resources or spend the least amount of manpower, material and money (resource optimization) for a specified progress.

IV. The "Multi-Level Coordination" of the Human Body System

After a long period of biological evolution and natural selection, the biological control system of a human body has acquired a multilevel coordination control function. One of the important features of the biological regulatory system is the "dual" regulation in coordinated control. For example, the blood pressure is under the "dual" regulation of the sympathetic nerve and the parasympathetic nerve, and the blood sugar level is under the "dual" regulation of insulin and glucagon. In addition, in the multilevel control of the nerve-liquid system, there is "rapid" control by the nerve and "slow" control by the liquid, as well as coordinated "regional" control and "functional" control. Also, in the theory of traditional Chinese medicine, the question of "coordination" is stressed. Jing-luo has the ability to "coordinate yin-yang and equilibrate fulfillment and emptiness." The so-called "jing-luo" is actually the human control system that governs the life activity. The brain is the

"home of the primary spirit" and is the highest control of the jing-luo system. The "governing pulse" controls all the yang-jing in the body and the "passive pulse" controls all the yin-jing in the body; these are second level controls. The third level control is the 12 jing-pulses made up of 6 yang-jing and 6 yin-jing. All the large and small luo-mai and sun-mai distributed all over the body are the low level local controls. Through the multilevel coordinated control of yin-yang and the five elements, the jing-luo system upholds the spirit, repels evil, determines life and death, and controls the normal activity of the human body.

V. Coordination of the "Man-Machine" System

"Man-machine" coordination is the key question in "man-machine" engineering (or, engineering psychology). By studying the interaction of man and machine and coordinating the man-machine relationship, an optimum match can be achieved between the characteristics of man and the characteristics of the machine.

For "man-machine" coordination, one needs to study man as well as machine. Based on the control properties of man and machine (signal transmission, conversion and processing characteristics), a "man-machine" interface can be properly designed. See Figure 4.

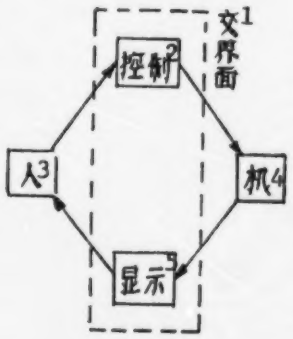


图4. "人——机" 系统

Figure 4. "Man-machine" system.

Key:
1. Interface
2. Control
3. Man
4. Machine
5. Display

The "man-machine" interface consists of a "display" and a "control" mechanism. For example, in the "man-machine" system of the pilot and the airplane, the interface is the instrument panel and the control rod.

In "man-machine" engineering, qualitative and quantitative studies should be carried out in designing the interface. Signal input and output characteristics of "man" should be tested and analyzed. Based on extensive actual data, display instruments can then be designed. The control mechanism is designed so that the signal input and output characteristics of the machine match those of the man and achieve "man-machine" coordination.

VI. Coordination in Social and Economic Fields

Lack of coordination in social and economic fields causes a number of problems, such as social unrest and lack of unity, internal conflicts in people, unbalanced production and consumption, unbalanced financial revenue, economic deficit, and unbalanced import and export in trade. It is often claimed that the key to coordination is management. Management problems include irrationality and shortfalls in the management system, lack of a sound basis for management policy, unscientific management method and uncoordinated management practice. Improvement of management lies in the coordination of all parties involved.

Coordination and balance are stressed in sociology and economics, and many publications in social and economic science frequently discuss the question of coordination. However, most of the discussions are qualitative and consist of descriptive studies or description of experience; very few are quantitative analyses or studies using modern scientific methods and tools such as control theory, system theory, information theory or the electronic computer.

Whether the subject is engineering technology, biological ecology or social economics, there are certain common rules and features in coordination. A new topic for natural scientists, social scientists and economists is the question of whether one can borrow the principles, methods and techniques of coordination in engineering technology that have been proven effective and use them in the fields of sociology and economics by analogy, and whether new principles and methods can be developed for sociology, economics and engineering through the inspiration of studying the coordination in biological control systems.

Because of the enormous size and the many factors involved, the situation in sociology and economics is very complex. For "active systems" where the human factor is involved, man's initiative must be taken into account so that the activity and creativity of man can be fully developed. People have used the method of "response theory" in studying the "cooperation" problem by members of an active system. It is believed that the "fair play" principle can be used in formulating an optimum plan for an economic system to the satisfaction of all members. In addition, because of the ambiguity of human language and behavior, the methods of "ambiguity mathematics" have also been used in the study of social systems, such as how to assign jobs to workers so that each member can be most effective and the entire organization can be coordinated to achieve the maximum efficiency.

Coordination is a problem common to engineering, biology, sociology and economics. Is it possible to develop a cross-discipline fringe science called

"coordination science"? This new science would include qualitative as well as dynamic and static analysis of various coordination processes such as the "coordinatability" of systems, the stability and speed of coordination processes, the accuracy of coordination control, and the reliability and economics of coordination systems. Various coordination systems would be integrated in designing the optimum efficient coordination system.

(Edited by Song Hezhou [1345 3109 3166])

9698
CSO: 4808/87

AUTHOR: SHI Zengjiang [0670 2582 3068]

ORG: None

TITLE: "New Energy Saving Product, the X6130 Diesel Engine, Produced by Hangzhou Automobile Engine Plant"

SOURCE: Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 6, 25 Jun 82 p 21

ABSTRACT: A new Huanghe brand JN-162 10-ton diesel truck is being shown in the new-product exhibition of the Ministry of Machines No 1. This truck is installed with the X6130 diesel engine, a 1981 new product of the Hangzhou Automobile Engine Plant. The plant was requested by the Machine Committee of the State Council to design engines that meet the requirements of 4-modernization construction and energy conservation, for the Huanghe brand 10-ton truck and 20-ton tractor newly developed by Jinan Automobile Manufacturing Plant and for other machineries of engineering construction. The major characteristic of the X6130 is its low oil consumption, high horsepower rating, light weight. It external size is basically identical (slightly smaller) with the old product, the 6120. The maximum power is 210 horsepower/2100 rotation/minute. The maximum torque is 80 kg·m (1400 rotations/minute). The minimum diesel oil consumption is only 163 g/horsepower hour. As the power and torque are raised 30 percent, compared with the 6120, the oil consumption is reduced 8.5 percent. The X6130 uses a high heat efficiency direct spray burn system. Many measures are adopted to improve the strength of its structure.

AUTHOR: HUA Yuxiang [5478 3768 4382]

ORG: None

TITLE: "The EQ140S5 Large Passenger Car Chassis Will Soon be Produced"

SOURCE: Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 6, 25 Jun 82 p 57

ABSTRACT: The EQ140S5 large passenger car chassis, designed by the Automobile Plant No 2 will soon be officially put into production. The chassis is 8.66 m in length. It may be used to install large, long distance, 45-passenger buses. It has the EQ140 engine, the transmission and hanging systems. Its advantages include large horsepower rating, high speed, and low oil consumption. It is also safe and reliable. Last year, the Automobile Plant No 2 dispatched many technicians to survey the market of many places, to listen to the opinions of passenger bus assembly plants of the Ministry of Transportation, etc. to learn the fact that the JT662 large passenger bus is in the greatest demand in the country. With the support of many passenger car assembly plants, the Automobile Plant No 2 completed the work of designing and experimenting in a very short time to make this chassis with the JT662 as the chief target. This chassis has been included in this year's new product production plan.

6168
CSO: 4009/376

AUTHOR: ZHOU Ding [0719 1353]
FAN Ailing [5400 1947 0109]
HUANG Rongtai [7806 2837 3141]

ORG: All of the Department of Chemistry

TITLE: "Research on Al-Mg-Zn Alloys Used as Material of Expandable Anode for Protection of Underground Oil Pipelines"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 pp 114-115

TEXT OF ENGLISH ABSTRACT: Based on our research, in 1963 the author of this paper was the first in China to study and suggest Al-Mg-Zn alloys be used as material of expandable anodes for protecting the underground oil pipeline. The industrial experimental application of the Al-Mg-Zn sacrificed anodes was done at Daqing in 1965. Good results were obtained in the pipeline has been well protected until the present time. In 1975, Al-Mg-Zn anodes were adopted again to protect the underground Fangshan-Beijing pipeline (236 km) from corrosion.

9717
CSO: 4009/367

AUTHOR: SHENG Xian [4141 6343]

ORG: None

TITLE: "Heat Machine Pneumatic Thermodynamics, Engineering Thermodynamics, and Energy Conservation Conference Held"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 4, 15 Dec 81 p 22

ABSTRACT: The Heat Machine Pneumatic Thermodynamics, Engineering Thermodynamics, and Energy Conservation Conference, jointly sponsored by Chinese Engineering Thermophysics Society and Chinese Aviation Society was held in Xiamen on 19-23 Aug 81. More than 100 papers were read. Dr. Liu Ruisen of France attended by invitation and delivered a report , entitled "A Method of Calculating Ternary Flow." A Heat Transfer, Mass Transfer, and Burn Science Conference, jointly sponsored by Chinese Engineering Thermophysics Society and Chinese Aviation Society was held in Huangshan of Anhui Province on 16-22 Oct 81.

AUTHOR: ZHU Xueguo [2612 1331 0948]

ORG: None

TITLE: "National Standard and Ministry of Agricultural Machinery Standard Inspection Conference for Eight Items, Including Internal Combustion Engine Piston Ring Technical Condition was Held in Hangzhou City"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 4, 15 Dec 81 p 31

ABSTRACT: In accordance with the 1981 standardization work plan of the National Bureau of Standards and the Ministry of Agricultural Machinery, a conference was arranged and held on 7-13 Sep 81 in Hangzhou City to formulate the national standard and the Ministry of Agricultural Machinery Standard for internal combustion engine piston, aluminium piston, cylinder cover, main axial and connecting rod bushing, connecting rod screw, connecting rod nut, and timing gear. Participants included 73 delegates representing the National Bureau of Standards, Ministry of Agricultural Machinery, Ministry of Transportation, Zhejiang Provincial Bureau of Agricultural Machinery, Hangzhou City Bureau of Machinery, and some assembly plants, research institutes, parts companies, and transportation companies. The delegates listened to the reports of those who prepared the draft, explaining the process of formulating the major technical indices and the condition of testing and verification work. The wording of the standard for each item was analyzed and compared, and similar standards of foreign countries were cited as a reference.

AUTHOR: HOU Tianli [0230 1131 3810]

ORG: None

TITLE: "Zhejiang Province Called an Internal Combustion Engine Energy Conservation Conference"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 4, 15 Dec 81 p 58

ABSTRACT: On 13-16 Oct 81, the Zhejiang Provincial Agricultural Machinery Society and the Provincial Bureau of Agricultural Machinery called a joint conference to discuss internal combustion engine energy conservation and to exchange experience. The conference was held in Xinchang Diesel Engine Plant; 83 delegates representing related schools of higher education, scientific research organizations, internal combustion engine and parts producing plants, and agricultural machinery and fuel management departments in the province. The deputy secretary of the society spoke on the energy supply situation of China and Zhejiang Province and clarified the fact that fuel conservation in internal combustion engines is especially important for Zhejiang Province which has no petroleum or coal. Special reports on fuel conservation were delivered by 13 delegates; the current oil saving experiences in Zhejiang Province were discussed and summarized. An associate professor of Zhejiang University reported the condition of the conference for establishing the Chinese Internal Combustion Engine Engineering Society. Some members of that society were invited to the conference to make special reports on "Research and Manufacture of the ZH1100W Single Cylinder Diesel Engine," and "Fuel Consumption Level and Fuel Saving Measures of Modern Medium and Small power Diesel Engines."

AUTHOR: ZHOU Nanqi [0719 0589 2630]

ORG: None

TITLE: "Shanghai Municipal Agricultural Machinery Society Held Its First Annual Conference"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 4, 15 Dec 81 p 70

ABSTRACT: The First Annual Conference of the Shanghai Municipal Agricultural Machinery Society was held in the Shanghai Science Hall on 12-13 Oct 81. A total of 377 persons attended and of these 322 persons were members of the society. Reporters of RENMIN RIBAO and JIEFANG RIBAO were invited. The conference received 61 papers and 16 of these concerned the motive power aspect. Through democratic secret balloting, the 35 new members were elected to the board of directors. These newly elected members included old specialists who had worked in the field of agricultural machinery for tens of years as well as some young persons who had just started to work in the field.

6168
CSO: 4009/370

AUTHOR: GAO Jinchang [7559 4244 2545]
YANG Yajun [2799 1246 0689]
ZHOU Chunhui [0719 2504 2547]

ORG: All of Zhejiang University

TITLE: "Control Scheme for Distillation Column and Energy Consumption"

SOURCE: Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese No 2, 1982 pp 12-19

TEXT OF ENGLISH ABSTRACT: This paper, using new distillation column energy consumption formulas and characteristic diagram, discusses and evaluates several ordinary control schemes from both steady state and dynamic energy consumption points of view. Through experimental studies and digital simulation, we have fully proved that our method is very useful in the evaluation and development of energy saving control schemes for distillation columns.

AUTHOR: FANG Xiong [2455 3574]

ORG: Shanghai Public Utilities Research Institute

TITLE: "A New Approach to Synchronization in Telemetric Systems"

SOURCE: Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese No 2, 1982 pp 20-27

TEXT OF ENGLISH ABSTRACT: In order to accomplish bit synchronization, the conventional technique in telemetric systems is to use the same frame synchronization codes derived from the control station. But this is not an ideal technique in practice. After a comparison of several typical design ideas, it is concluded that a better choice is the method of "frame information carried by synchronization codes with information codes carrying bit information," which has been practiced in the Intel 8273 HDLC/SDLC controller as a typical example.

However, NRZ_1 codes used in the 8273 controller have some inherent drawbacks in carrying bit information. In our approach, instead of the NRZ_1 code system we have used the Miller Code System, the full advantage of which has long been enjoyed in magnetic recording techniques.

[Continuation of XINXI YU KONGZHI No 2, 1982 pp 20-27]

The author has designed the encoding and decoding logic in terms of the Miller Code System. The resulting circuitry is quite simple and those drawbacks inherent in the 8273 controller have been eliminated. It seems that this new approach will also be advantageous to similar designs other than those in telemetric systems.

AUTHOR: Bu Zixiang [2975 1311 4382]

ORG: Shanghai Chemical Fiber Plant No 5

TITLE: "Coal Economization and Automatic Control of Industrial Boiler Burning Processes"

SOURCE: Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese No 2, 1982 pp 56-59

TEXT OF ENGLISH ABSTRACT: Based on an analysis of α control and dynamic match, this paper reveals the mechanism of coal economization in automatic control of boiler burning processes. Several actual examples are described that have already reaped economic advantage, and the current state of coal economization in automation of industrial coal burning boilers is reviewed.

9717
CSO: 4009/344

AUTHOR: XIA Zenglu [1115 1073 4389]

ORG: Research Institute of Geography, Chinese Academy of Sciences

TITLE: "Characteristics of Cadmium Pollution, Its Regional Balance, Environmental Capacity, and Prevention in the Southeast Suburbs of Beijing"

SOURCE: Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENT SCIENCE] in Chinese Vol 3 No 2,30 Apr 82 pp 14-18

ABSTRACT: The southeastern suburbs of Beijing are located on the middle and lower parts of the Yongding River alluvial fan. The topography is flat and the Quaternary deposit is thick, mostly in the 60-200 m range. The ground water belongs to the pressure bearing type, but is rather shallow, mostly at about 1-2 m. The annual mean rainfall is 600mm, mostly in the summer. During the dry and windy winter and spring, the evaporation is tremendous. In the region, 470 thousand mu of fields are irrigated with wastewater for as long as 7-15 years. After the wastewater is treated, the sludge is used as fertilizer. Cadmium contamination originates mainly from industrial discharge, about 650 kg/year, with some (about 131 kg) from fuel coal of the upper reaches. The cadmium content of the surface water is mostly below 1ppb (the standard is 10ppb.) Due to the fact that the water output is greater than the input, the regional cadmium accumulation also includes the portion in the input water, estimated at 30 percent of the total annual accumulation. After the horizontal and vertical distribution of Cd in the soil of the region is com-

[continuation of HUANJING KEXUE Vol 3 No 2, 1982 pp 14-18]

puted, the paper states that the current accumulation of 393 kg in the region is about 25 percent of the maximum permissible capacity and in another 35 years, the maximum for the use of wastewater and sludge will be reached. For prevention of further contamination, the paper suggests that: (1) The sludge should not be applied as fertilizer and should be further treated (such as burned) ; of course, this process will mean waste of energy and fertilizer as well as atmospheric pollution. (2) The sludge should be transferred to other remote regions to be used as fertilizer, but no more than 1,000 jin/mu should be applied. (3) Adding suitable quantities of nitrogen, phosphorus, and potassium to the sludge at the treatment plant to be sold nationwide as a fertilizer. (4) The Beijing Chemical Plant discharges 65 percent of the total Cd in the region; if this discharge is treated at the plant, the sludge of the Gaobeidian Wastewater Treatment Plant will be safe as a fertilizer.

AUTHOR: HOU Shaofan [0230 1421 5400]
ZHU Zhenyuan [2612 2182 3293]

ORG: Both of Research Institute of Geography, Chinese Academy of Sciences

TITLE: "Low Selenium Environment and Vitamin E in Human Serum Relative to the Kaschin-Beck's Disease"

SOURCE: Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENT SCIENCE] in Chinese Vol 3 No 2, 30 Apr 82 pp 18-23

ABSTRACT: In China, endemic regions of Kaschin-Beck's disease, Keshan disease, and animal white muscle disease basically overlap, mainly the transitional area between the moist Southeast and the arid Northwest. Tests conducted by the authors reveal that the selenium content of major soils of the regions affected by the diseases is 0.088-0.360 ppm, that of the grains below 20-30 ppb. Of the inhabitants, 94 percent have serum selenium content below 0.031 μg/l and the selenium content of the hair of inhabitants is 100-200 ppb. From Jul 79 to Jun 80, the authors treated 41 cases of Kaschin-Beck's disease with sodium selenite-V_E and 36 of them recovered from the disease. Based upon these data, the authors believe that environmental selenium deficiency of these regions is perhaps the cause of the low level selenium nutrition of the inhabitants. The low level selenium nutrition in turn leads to a reduction of certain enzymic activity to cause the Kaschin-Beck's disease, as well as the Keshan disease and the animal white muscle disease.

AUTHOR: XU Fang [1776 2455]
JIN Yinlong [6855 6895 7893]
ZHANG Quanzeng [1728 0356 1073]
YIN Chunfu [1438 2504 7683]
ZHU Yuling [2612 3768 3781]

ORG: XU, JIN, ZHANG, YIN of Research Institute of Hygiene, Chinese Academy of Medical Sciences; ZHU of Shandong Provincial Public Health and Epidemic Prevention Station

TITLE: "Chromosome Aberration Within Lymphocytes of Fishermen on the Hong Island"

SOURCE: Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENT SCIENCE] in Chinese Vol 3 No 2, 30 Apr 82 pp 28-30

ABSTRACT: Intravenous blood and hair samples of 41 healthy fishermen on Hong Island in Jiaozhou Bay and a control group of 28 workers of nearby factories and a hospital are taken to compare the incidence of chromosome aberration and the mercury content of hair. The incidence of chromosome aberration of the fishermen and that of the control is 0.69 and 0.66 percent respectively, a difference not statistically significant. The mercury content of the hair of the 2 groups is 1.181 ppm and 0.608 ppm, obviously statistically significant. The fishermen eat 6-22 jin/month of seafood and the control group only 2-3 jin/month. Analyses of the seafood fail to reveal exceedingly high mercury content, however. The sea of Jiaozhou Bay is relatively severely contaminated by mercury, cadmium, arsenic, and crude oil.

AUTHOR: JIANG Meizhen [5592 5019 3791]
LIU Jiarong [0491 0857 5554]

ORG: Both of Hangzhou Botanical Garden

TITLE: "Purification of Sulfur Dioxide in the Atmosphere Around the West Lake of Hangzhou"

SOURCE: Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENT SCIENCE] in Chinese Vol 3 No 2, 30 Apr 82 pp 31-33

ABSTRACT: In the area surrounding the West Lake, there are 3,389 mu of parks and 60,189 mu of forests. The vegetative coverage is above 70 percent. Industries have developed very rapidly in nearby Hangzhou City in recent years and surveys indicate 27 types of atmospheric pollutants, with SO_2 the most serious. Samples of plants were taken to study the effect of the atmospheric SO_2 on them and their purification effect on the pollutant. The sulfur content of the leaf-samples was found to vary with the season, reaching a peak in Jan-Mar, at 2,655-4,605 mg/g. Artificial fumigation experiment indicated that most of the plants of the region are resistant to SO_2. Of the 137 tree species tested, 82 species are highly resistant, 40 medium, and 15 weak.

AUTHOR: LIN Hanzong [2651 3352 1350]

ORG: Research Institute of Hygiene, Chinese Academy of Medical Sciences

TITLE: "An Investigation of the Relationship Between Dietary Intake and The Metal Content of Hair and Urine of Fishmen"

SOURCE: Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENT SCIENCE] in Chinese Vol 3 No 2, 30 Apr 82 pp 65-68, 33

ABSTRACT: For the purpose of understanding the effect of ocean pollution on human health, an investigation into the heavy metal content of food, hair, and urine of 2 groups of fishermen, 61 in Hongdao and 60 in Zhangzidao, both islands in Jiaozhou Bay, 10 nautical miles from Qingdao. Test results indicate the metal intake of the fishermen is, on the average, 0.015-0.029mg of mercury, 0.047-0.025 mg of lead, 0.056-0.005 mg of cadmium, and 0.29-0.21 mg of arsenic per person per day. The metal content of their hair is 1.60-2.10 μg/g of mercury, 9.49-2.27 μg/g of lead, 0.20-0.05 μg/g of cadmium. The metal content of their hair is 0.0009 and 0.0017 mg/l of mercury and 0.16-0.12 mg/l of arsenic. The above findings indicate that the contents of metals in the fishermen's hair and urine do not exceed the normal of domestic or foreign reports.

AUTHOR: WANG Da [3769 6671]
WANG Hengwen [3769 5683 2429]

ORG: Both of Shanghai Research Institute of Cytobiology, Chinese Academy of Sciences

TITLE: "Some Methodological Problems in Environmental Toxicology Research"

SOURCE: Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENT SCIENCE] in Chinese Vol 3 No 2, 30 Apr 82 pp 73-7[illegible]

ABSTRACT: All the factories of Shanghai have good labor protection systems. The cause of death of all workers is clearly recorded and the hospitals have complete case histories of cancer survivors. In the course of the 1970 cancer survey, the authors discovered, however, the recorded data are only limitedly reliable. The problems are as follows: (1) The size, the number of workers, and the length of establishment of the factories vary too much for statistical processing; (2) The products and work procedures of some factories have changed frequently and many workers have changed their occupation or been transferred; (3) Some data are incomplete and some diagnoses not dependable. Problems regarding environmental pollution inspection and animal experiments are also discussed.

6248
CSO: 4009/343

AUTHOR: YU Zhiqin [0060 1807 0530]
FANG Weijie [2075 3634 2212]

ORG: YU of Changchun Optical Machinery Institute, Chinese Academy of Sciences; FANG of Jilin Provincial Research Institute of Machine Industry Design

TITLE: "Present Condition and Future Prospect of Laser Devices and Laser Heat Treatment"
SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 6, 25 Jun 82 pp 1-6

ABSTRACT: Laser scientists and heat treatment scientists are cooperating very closely in China to carry out extensive and profound research on laser surface treatment technology. At present, the technique of laser surface phase conversion hardening heat treatment is the relatively better grasped one and very actively applied to cast iron surface treatment in the automobile manufacturing industry in China. In the future, medium power (1-5 kw) CO_2 laser devices should become commercialized and large power CO_2 laser devices (5-20 kw) should be developed especially in terms of resolving the problems of useful life and reliability. With the development of industrial use CO_2 laser devices, applications of laser surface treatment in industrial production will undoubtedly increase. The types and characteristics of laser devices and problems of optics in laser heat treatment are introduced. Extensive research is being carried out on the size and depth of focus, the scanning speed, the width and depth of the hardened zone, the productivity, the hardness distribution, and the surface darkening treatment etc. especially on the interrelationship of

[continuation of JINSHU RECHULI No 6, 1982 pp 1-6]

these parameters. The authors have conducted some research on the phase conversion hardening of cast iron and some major types of steel but more studies are needed. Attention should especially be given to laser amorphorization but this will mainly depend upon progress in the development of high power laser devices and certain special alloys. Tools for laser heat treatment, especially the laser device, require a great deal of investment and their transportation and maintenance are also costly. The establishment of laser heat treatment centers for national and/or regional use to improve their rate of utilization is suggested. Moreover, it is also suggested that only those parts of very complicated shapes, requiring the deformation to be very little, and impossible to be treated otherwise should be included for laser heat treatment and of course only if the property of such parts is to be extremely obviously improved after laser heat treatment.

AUTHOR: None

ORG: The Secretariat, Chinese Society of Mechanical Engineering Heat Treatment Society

TITLE: "Conference News"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 6, 25 Jun 82 pp 64- inside back cover

ABSTRACT: On 9-11 Apr 82, the Chinese Mechanical Engineering Heat Treatment Society held its Fourth Expanded Conference of the Board of Directors and 34 current directors and 21 alternates attended. The essential condition of work of the society since the Third Conference held in Aug 80 was reported by the deputy directors and the general condition of the First International Materials Heat Treatment Conference held in Oct 81 in which the delegation representing the Chinese Heat Treatment Society participated was reported by the chief secretary of the society. The deputy secretary also summarized for the conference the progress of the work of preparing for the Third International Materials Heat Treatment Conference to be held in Shanghai in 1983. Those responsible for the various study groups also reported their respective activities in the past year. Following some enthusiastic discussions, the conference resolved, among other items, that: (1) The Third National Heat Treatment Conference is to be held in Xi'an City in early Nov 82 and about 80 papers are to be selected for discussion; (2) Based upon the International Materials Heat Treatment Joint Board of Directors' suggestion, the papers to be submitted by

[continuation of JINSHU RECHULI No 6, 1982 pp 64 - inside back cover]

China to the Conference to be held in Shanghai will be on 8 specific subjects. They will be selected principally from the papers submitted to the annual national conference. (3) In the future, JINSHU RECHULI XUEBAO will publish chiefly theoretical papers while JINSHU RECHULI will emphasize papers closely related to production practice. It is hoped that the quality of the latter will continue to improve to resolve some problems of actual production through discussion. (4) A series of books on heat treatment are to be published and an editorial committee of 16 members is established for that purpose. (5) With the cooperation of Beijing Science Education Motion Picture Plant, a motion picture introducing the condition and achievements in heat treatment in ancient and present China is to be prepared. (6) The next conference of the board of directors is to be held in Xi'an in Nov 82 just before or after the annual conference of the society.

6248
CSO: 4009/364

AUTHOR: TAN Zugen [6223 4371 2704]

ORG: Zhejiang University

TITLE: "Some Views on the Development of Transducers in China"

SOURCE: Xi'an GONGYE YIBIAO YU ZIDONGHUA ZHUANGZHI [INDUSTRIAL INSTRUMENTATION AND AUTOMATION] in Chinese No 2, 5 Apr 82 pp 5-6

ABSTRACT: A transducer converts one form of energy to another and its precision affects the accuracy, stability, and reliability of a meter no matter how excellent are the other parts of the instrument. The research and production of transducers have had some progress in China in recent years but they remain few in quantity, incomplete in types, and poor in quality. This paper discusses mainly the importance of transducers and reports the measures taken in foreign countries, especially England, to guarantee the quality of transducers and inspect them with special instruments. In China, the properties of some transducers are usually emphasized during their experimental manufacturing stage, but when they are being produced in small batches, attention is generally not given to the work procedures which influence the stability and reliability of the transducers. Their initial property indices are usually satisfactory, but after they have been used for a period of time, their properties often deteriorate with time. The author suggests that if every work procedure is emphasized, the quality of the Chinese-make transducers should improve. The author also believes that it is necessary to carry out research and make new types of transducers in China, especially to meet the needs for developing large scale integrated circuits.

6248

CSO: 4009/369

AUTHOR: LU Qingxiong [4151 1987 3574]
WANG Guojun [3769 0948 6874]
HU Bingwen [5170 4426 2429]

ORG: All of Jilin Industrial University

TITLE: "Present Situation and Future Prospect of Automation in Machining Process in China"

SOURCE: Dalian ZUHE JICHUANG [MODULAR MACHINE TOOL] in Chinese No 6, 25 Jun 82 pp 30-34

ABSTRACT: Some statistical data regarding the present condition of automated machining are reported. For example, modular machine tools are used in 61.2 percent of the automated machining lines. In terms of parts, 31.6 percent of steel parts, 61.7 of cast iron, and 6.7 of colored metals are machined on automated lines. In automatic measurement, there are 29 automated lines in the agricultural machinery system, among others, but in most cases the work condition remains less than satisfactory. In automatic compensation, some work has begun in Dalian Modular Machine Tool Research Institute of the Ministry of Machines No 1, the Third Academy of the Ministry of Agricultural Machinery, etc. but in all cases, the work is still in the experimental stage. In digital and group control, the problem is primarily the high cost of manufacturing. Stability and reliability of the more complex digital control machines also present some problems. In group control, according to the survey of the authors, some 10+ organizations, including Shanghai Machine Tool Electrical Instrument Plant No 2, Shenyang Air-blower Plant (using an imported IBM-370 computer), etc. have

[continuation of ZUHE JICHUANG No 6, 1982 pp 30-34]

adopted it and in general, the product quality is stable and the work efficiency has been raised 5-6 fold. The second part of the paper devotes to a discussion of the future prospect of automation in machining in China. Although the major direction of development is toward high precision, high efficiency, and automation to guarantee the quality of products, to improve the labor condition, to raise the labor productivity, and to gain a greater economic benefit, during the current stage of readjustment of the national economy, China's foundation of automation is poor and problems are numerous. The potential is endless, but in terms of offering highly automated equipment for manufacturing in the textile industry, hardware and electrical appliances, and agricultural machinery, the prospect is very good because of the very large sales market, but the technology of automation in China is still relatively backward, especially in the aspect of electrical automatic control. At present, it is still primarily a relay control device. Further advancement depends upon improved mastery of the electronic technology.

6248
CSO: 4009/365

AUTHOR: ZHENG Zuyao [6774 4371 1031]
WANG Fengcheng [3769 7364 6134]

ORG: None

TITLE: "Standard Mercury Thermometer for 300-500°C"

SOURCE: Beijing JILIANG XUEBAO [ACTA METROLOGICA SINICA] in Chinese No 3, 22 Jul 82 p 240

ABSTRACT: Beijing Research Institute of Glass was given the responsibility of making the standard 300-500°C thermometer; the Chinese Academy of Metrology and the Beijing Municipal Research Institute of Metrology participated in the task of carrying out the research. The product has been approved by the National Certification Conference in Sep and been given to Beijing Research Institute of Glass to put into production. Different grade of glass materials must be used to make this type of mercury thermometer depending upon the different range of temperature it is to be used to measure. Some artificial aging treatment process is also necessary. The research and manufacture of this type of mercury thermometers had never before been done in China. A blank is therefore filled by this product. It is composed of 4 branches: the temperature measurement interval of each branch is 50°C; there is is a zero place marker. The certification document indicates that the error rate is $\pm$ (0.10 - 0.20)°C. The major technical parameters of the thermometer are included in the paper.

6168
CSO: 4009/374

AUTHOR: LI Zhongmin [2621 1813 3046]

ORG: Motor Division, Liming Machinery Company, Shenyang

TITLE: "Research to Make China's First Medical Use Cast Titanium Vacuum Furnace Has Succeeded"

SOURCE: Shenyang ZHENKONG [VACUUM] in Chinese No 3, 25 Jun 82 pp 1-4

ABSTRACT: Medical scientists in China are giving a great deal of attention to the technique of using titanium or titanium alloy as replacement for human skeletal bones. The Shenyang Troop General Hospital has applied it in its Stomatology and other clinical departments and produced satisfactory results. To process titanium into a shape of a bone needed by a patient is as time consuming as carving it out of jade, however. Some hospitals have tried to forge or machine tooling titanium bones but the production efficiency is very low. It is very wasteful to use a large capacity furnace to make a bone weighing less than one kg. These are very difficult problems in applying the technique. In 1978, the Shenyang Troop General Hospital and Liming Machinery Company jointly accepted the job of making a special vacuum furnace for just this purpose. After 3 years of research, on 16 Apr 81, some artifical bones, including the femur, the mandible, the skull bones, teeth, and lower limbs and joints, were successfully cast-produced for the first time. Of these, the joint bone has been applied

[continuation of ZHENKING No 3, 1982 pp 1-4]

to a patient on 12 May 81. Photos are included in the paper to illustrate this fact. The work principle of the vacumm furnace is introduced.

AUTHOR: ZHAO Chengxiu [6392 2052 0208]

ORG: Shenyang Research Institute of Vacuum Technology

TITLE: "Roots Blower Pumps Should be Extensively Developed in China"

SOURCE: Shenyang ZHENKONG [VACUUM] in Chinese No 3, 25 Jun 82 pp 45-47

ABSTRACT: Advantages of roots blower pumps, including obvious energy saving effects, low oil steam back-flow, realization of 10^{-1} - 10^{-8} exhaust and free of oil pollution, etc. are introduced, citing unnamed Japanese journals and literature provided by the Hibon Company of France. Some information regarding the condition of development of roots blower pumps in foreign countries is available in a book, ZHENKONG GONGYE, published by the Information Center of the Ministry of Machines No 1 and the paper briefly mentions its growing application in such developed countries as the USA, Japan, France, and Italy, in the 70's. In China, with the introduction of unified designing, standard, and work procedure among the vacuum industries, the product quality has been improved a great deal in the past few years and some of the products have entered the export market in small quantities. In general, the level of the vacuum technology is still not high and the development of the various types of pumps uneven. The condition of development of the roots blower pump remains the same as the description in the 1974 paper (ZHENKONG JISHU BAODAO No 3, 74 p 12). There are complaints about the sharp noise of Chinese-make roots blower pumps

[continuation of ZHENKONG No 3, 1982 pp 45-47]

and the vacuum seal leaking very easily. Some people think it is risky to use them inspite of their acknowledged advantages over other types of pumps. These 2 problems undoubtedly must be resolved before the application of roots blower pumps may be extended in China. The author suggests that for the purpose of satisfying the development needs of the national economy, efforts should be quickly organized for cooperative research and development in roots blower pump to resolve these existing problems.

AUTHOR: None

ORG: Information Office, Shenyang Research Institute of Vacuum Technology

TITLE: "The Second Work Conference of the Vacuum Equipment Industry Information Network Was Held in Shantou"

SOURCE: Shenyang ZHENKONG [VACUUM] in Chinese No 3, 25 Jun 82 back cover

ABSTRACT: The Second Work Conference of the Vacuum Equipment Industry Information Network was organized under the guidance and support of the Information Centers of the General Bureau of General Purpose Machines of the Ministry of Machines No 1, the Shantou Municipal Bureau of Machine Industry No 1, and the Shantou Vacuum Machinery Plant and held in Shantou on 11 - 15 Apr 82; 23 persons representing 15 organizations attended. The work of the information network in the past year was summarized to affirm positive achievements and to find the shortfalls. The work plan for 1982-83 was discussed and formulated. Comrades of the Information Center of the Ministry of Machines No 1 brought many models and materials from Beijing to exhibit at the conference and the delegates were very impressed. The paper does not mention any special subject or special type of information concerning any vacuum technology having been discussed at the conference. The paper mentions speeches and reports delivered by this and that person but not the nature or the content of these reports.

6248
CSO: 4009/363

AUTHOR: GUO Hualin [6751 5478 2651]

ORG: Guilin Measuring and Cutting Equipment Plant Research Institute

TITLE: "Adjustment, Repair, and Inspection of the QP373 Transmission Testing Device"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 4, 18 Jul 82 pp 31-33

ABSTRACT: The QP373 is a special instrument used for research, manufacture, installation, maintenance, and repair of carrier wave equipment of long distance telecommunication. The author has had some experience in adjusting, repairing,and inspecting the type of instrument like the QP373. The paper includes a table listing 6 types of possible problems with this instrument: (1) The indicator light is out so that there is no way for the instrument to display the result of measurement; (2)The indicator light is on but there is no indication for correction I, II, wide band, and frequency-selective device measurement; (3) Correctinn I, II are normal, but there is no indication for wide band and frequency-selective device; (4) No indication for normal, correction I, II; (5) Indicator either continues to swing or gives no indication for frequency-selective device correction II and frequency-selective measurement; (6) Accurate wide band measurement, but frequency-selective measurement is too high. The 5th type trouble occurs especially easily in the damp season in South China. The method of adjusting, repairing, or correcting the instrument to overcome each of these problems is detailed.

AUTHOR: LI Yuzhi [2621 3768 2535]

ORG: None

TITLE: "National Standard Examination Conference Approved the Aluminium Alloy Hardness and Strength Conversion Value"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 4, 18 Jul 82 p 56

ABSTRACT: Following more than 7 years of research work, and collectingnearly 80 thousand test data and verification data, China's own standard of"Aluminium Alloy Hardness and Strength Conversion Value" has recently been approved and put in force officially as the national standard. The National Standard Examination Conference regards it as a breakthrough in scientific research as well as technological application. A blank in China's basic standards is thus filled. This research result is a product of cooperation of the 8 organizations of China Academy of Metrology, Beijing Research Institute of Aviation, the 304 Institute of the Ministry of Machines No 3, the Civil Aviation Beijing Maintenance and Repair Base, and the Northeast Light Alloy Processing Plant. Besides, several tens of engineers belonging to 18 scientific research and production organizations also took on portions of the task.

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SCIENCE AND TECHNOLOGY

No. 171

CHINA EXAMINES SCIENCE POLICY

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TRANSLATING SCIENCE AND TECHNOLOGY INTO SOCIAL, ECONOMIC GAIN IS GOAL OF SCIENOLOGY

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese Vol 4, No 3, 10 Jun 82 pp 31-36

[Article*by Li Chang [2621 2490]: "The Present Task of Our Nation's Research in Science of Science"]

[Text] The science of science [also referred to as "scienology"], as a new field of science, has developed very rapidly abroad. It has also been noticed by various domestic circles in recent years. This is because modern science and technology have demonstrated a great force in creating wealth, thus people have taken science as an object of study to provide a theoretical basis and methods for management and decision making in scientific research and to guarantee the smooth development of scientific and technological endeavors. Since 1979, our nation has already held two national academic discussion conferences on the science of science. Now, we are holding a special topics discussion meeting on the science of science to explore the subjects of research in science of science and to discuss the characteristics and trends in the development of modern science and technology. I have been inspired by everyone's speeches and papers at the meeting. I shall talk about my personal views on some questions in the science of science.

I. We Need a Unified Fundamental Concept and Clear Research Targets

The study of science of science began rather late in our nation. It is still in its initial period. For nearly 3 years, everyone has been exploring freely, a hundred schools of throught have contended, and various opinions have been expressed. It seems now that doing so during the initial stage stimulates the development of this science. But such discussions have weaknesses: 1) The fundamental concepts are not consistent; 2) the research targets are too scattered.

First let us talk about the cause and the difficulties in the inconsistency of fundamental concepts. Because comrades studying the science of sciences come from all fields, their understanding of the science of science unavoidably is tainted by their own professions. The same thing has different explanations and the fundamental concepts are inconsistent. This creates confusion in the

*This article was a speech given by the author at the 1981 Discussion Meeting on the Theory of Science of Science

discussion of problems, therefore it is difficult to clarify doubts so that research can become more profound, and this hinders the growth of this science. I hope that everyone can self-conscientiously unify some fundamental concepts during the process of discussion and make the content of the central issues consistent so that we will have a common language when discussing problems.

Having dispersed research targets is also unfavorable. In the previous period, everyone explored freely from different aspects and even tried to establish a theoretical system for each type of science of science. During the stage of creating this science in our nation, this situation is difficult to avoid, but if our research targets remain scattered for a long period, our research work may fall into a situation where individuals have penetrated deeply into the subject but many will stray and become lost. Therefore, I suggest that this conference clarify the main research targets at present to concentrate strength, to link efforts with the actual situation and to solve several questions that need to be solved urgently. At the same time, free exploration can continue.

II. The Subject of Research in Science of Science

The subject of research in science of science is science, there is no question about it, but this needs explanation. Engels said in his work "The Dialectic Method and Natural Science": "The purpose of every branch of science is to analyze the forms of motion of the single element or a series of interconnected or mutually changing forms of motion." Since science of science is a science, what forms of motion does it analyze?

As an understanding of natural phenomena and laws by man, science has its system, structure, laws of inner development, and unique methodology. Scientific achievements are the body of knowledge about the various forms of motion in nature acquired by man and they are applicable throughout the nations of the world. Science of science studies these as its subjects, and science of science intersects and coincides with the scientific viewpoint and scientific methodology of natural dialectics. There is no clear boundary between science of science and natural dialectics, this is not surprising. As one form of motion develops from another form of motion, the reflection of these forms, i.e., the various branches of sciences, naturally develop from one another. This statement by Engels is a very good explanation of this phenomenon.

On the other hand, the development of science cannot be separated from the course of social movements of man's understanding of nature. It is organically linked with the politics, military affairs, economy and culture of different nations and they mutually influence each other. Science, as a social movement, is different in each nation, and it is inseparable from the productive technology of different nations. It has its own laws of development and its special laws in each nation. Science of science also takes this as the subject of research to provide a strategy and a theoretical basis for the development of science and technology.

Therefore, science of science is a science that "serves two purposes." It studies the laws of ideological development of man's understanding of nature, it also studies the laws of social movement of man's understanding of nature. If we take the book "The Social Function of Science" by J.D. Bernal as marking

the birth of science of science, then, it can be said that science of science or the main aspect of science of science is the study of the application of science in production and the study of science as a social movement, this means it studies science and technology as a whole.

Our nation's science and technology have fallen behind during the past several hundred years because of social and historical reasons. The whole nation was liberated and a new China of socialism came about. Our nation's society underwent a tremendous leap forward and science and technology developed greatly along with politics, the economy and culture. Since the crushing of the "gang of four," especially since the Third Plenum of the Party, our nation has entered a new era of building socialist modernization. We urgently need a greater development in science and technology. Under this situation, the urgent task that we face is to explore the special laws of science and technology in our nation under the guidance of Marxism-Leninism and Mao Zedong Thought and based on the general laws of the body of scientific knowledge and the development of scientific and technological endeavors and hasten its development so that it can develop a greater function in building our nation's socialist material culture and spiritual culture.

III. Several Problems That Should Be Studied With Emphasis at Present

According to the above understanding, I believe that the study of science of science in our nation should emphasis the solution of the following problems within a definite period:

1. We should explain the important function of science and technology in social development by combining theory and practice. At our nation's National Science Conference in 1978, Comrade Deng Xiaoping affirmed that science and technology are the scientific judgment of production. In capitalist nations, this has not been a problem for a long time because of the history of several hundred years of scientific development and application. Modern science was born and developed with capitalism centered in the cities. The Western capitalist class first used science as an intellectual weapon against feudalism, and later it used science as a means to generate wealth and to conquer the world. The Western capitalist class understands the important meaning of science and technology and their economic value. The situation in China is different. Our nation's feudal society once produced a brilliant culture and advanced science and technology, but development dropped during the final stage. Up to the time before liberation, our nation was still a semi-feudal and semi-colonial society. This was different from the democratic revolution of the Western capitalist class. The center of their revolution was basically in the cities, while the center of our revolution always remained in the farm villages. Finally, the farm villages encircled the cities and the cities were liberated. Therefore, our party and people are unfamiliar with recent and modern science and technology and with intellectuals engaged in scientific and technological work. For a long time, we have not had a sufficient understanding of science and technology as a productive force. During the 10 years of sabotage by Lin Biao and the "gang of four," they concluded simply that social practice was productive practice and class struggle. They totally rejected that scientific development directly originated from scientific practice

(theoretical research and observation, experimentation) and they rejected the great social function of science and technology. They forced scientific research to stop, disbanded scientific research agencies, and criticized intellectuals and the so-called "private ownership of knowledge." They have created a disaster for our scientific endeavors. Although the national science conference corrected the rule of leftist mistakes over our nation's scientific and technological battlefront and affirmed that science and technology are productive forces, but profound understanding of this scientific judgment is still a course of hard efforts that needs to be carried out.

Because of this, in March 1981, when the Central Secretariat heard the general report on the work of the Chinese Academy of Sciences, Comrade Hu Yaobang mentioned three things: First, the understanding of the importance of science and technology by the whole party and the whole people must be improved. Second, the Central Committee must have a correct policy and guideline for science and technology; Third, scientific and technological work must make important contributions. The task of researchers in science of science, in my view, is to explain the important functions of science and technology and to explain that science and technology are productive forces by combining theory with practice, by implementing the correct policies for science and technology and by taking forceful measures to realize visible economic gain. The more profoundly we explain the importance of science and technology, the scientific judgment that science and technology are productive forces, that science is a strong weapon to promote social progress and to develop civility, the more possible it is to launch a long-lasting enthusiasm of the whole nation to love science, learn science and use science. Our science and technology will develop even faster. But the solution to this problem is not something that can be done in a short time. It would be good if the understanding of the importance of science and technology by the whole party and the whole people can be elevated to a height it should have in 3 to 5 years or in an even longer period.

2. We should profoundly study the characteristics and trends in the development of modern science and technology. Since World War II, the rapid development of science and technology has brought about great changes in economic and social development in developed nations. It is important to study the characteristics and trends of development of modern science and technology so that we can grasp the laws of development of science and technology in the world as a whole and dynamically and so that when our nation draws up a strategy for the development of science and technology, we can have a basis for its general direction and we will not make mistakes.

The characteristics of modern science and technology should be categorized according to the following: (I) The scale of scientific and technological research is becoming larger and larger while division of labor is becoming more and more refined. It has already become a national endeavor in every nation or an endeavor massively supported by each government. (II) From the end of the last century to the beginning of this century, a series of technical sciences that reflect the laws of the second nature, i.e., the nature created by man, has been formed. (III) At the beginning of this century, a revolution in physics marked by the emergence of quantum theory and relativity theory has occurred. This has opened up a new realm of human understanding of the microcosmic world and the macrocosmic world of materials. (IV) Lateral sciences

such as cybernetics and information theory and systems theory have been born. (V) The three major technologies of atomic energy, computers and space technology have emerged. (VI) Management science has formed. (VII) The revolution in life sciences and bioengineering are forming and growing. Generally speaking, modern science and technology have already reached a high level. Sixty to 70 percent of the labor productivity in developed nations during the past 10 to 20 years have relied on science and technology. The scope of activity of human understanding has penetrated the basic particles, extended to entire star systems, and touched on the nature of life. Research in robots and artificial intelligence is developing. Science and technology will discover even greater natural potential, and science and technology are demonstrating their importance in economic and social development more and more.

Such a high level of modern science and technology and such an important social function of science and technology are the results of long term development of modern science. They are also the beginning of further development of science and technology at the end of this century and in the next century. What is the trend of development of the world's science and technology? What inspirations can we get from here if we want to realize our nation's scientific and technological modernization?

First, the development of recent and modern science and technology is a process of mutual stimulation and mutual penetration. The task of science is to understand the laws of natural development. Technology is the skill and the tool for people to change nature. Technological progress helps people develop science, and scientific development promotes and generates new technologies. Since the advent of modern science represented by Newtonian mechanics, and through Britain's industrial revolution, science has been applied to mass production and new technologies have continually emerged. The birth of electromagnetism and chemistry also brought about the birth of electrical technology and chemical engineering technology, thus opening up the electrical industry and the chemical industry. The development of atomic and nuclear sciences and modern mathematics and electronics in this century brought about the birth of applied technology of atomic energy and computer technology. In recent years, following the breakthrough in life sciences, a brand new bioengineering technology has emerged. The cycle of materialization of science to become a direct productive force is becoming shorter and shorter.

Second, history shows that nations in which science is most developed are also technologically advanced and economically the most prosperous nations. But there are also nations that are technologically advanced and economically prosperous while science is not the most advanced. Britain after the Industrial Revolution, Germany at the end of the 19th century and the United States after World War II were the world's centers of science at the time and were also the technologically most advanced and economically most prosperous nations. The United States at the beginning of this century and Japan after World War II were both very advanced in production technology and were major economic nations at the time. For example, the value of industrial production of the United States in 1894 was first in the world while the gross national product of Japan at present is next only to the superpowers of the United States and the Soviet Union, ranking third in the world. There is an important conditional factor here, that is, at the time, the United States and Japan both

enjoyed political stability and the economy rose. They imported new scientific achievements and new technologies en masse. At the same time, national education was developed. There was a definite scientific and technological strength. They had rich intellectual resources sufficient to apply, digest and continually improve imported scientific achievements and new technology.

Third, the three recent and modern technological revolutions served an important function in economic and social development. The characteristic of Britain's Industrial Revolution was the production and the application of machines and steam. It was actually a technological revolution. This revolution used machines to replace manual labor and steam to replace animal power, hydraulic power and human power. This greatly improved the labor production rate and gradual mechanization of industrial and agricultural production became possible. The second technological revolution was mainly the emergence and the development of transportation and communications machines (trains, ships, automobiles, airplanes, telegraph, telephone), materials for manufacturing machines and new production methods for rubber. Electricity, petroleum and natural gas were used as new energy sources. This greatly improved transportation and communications, strengthened the link between cities and villages, shortened the distance on earth, and developed domestic and international trade. Conversely, it also promoted the further development of the world's industry and agriculture. The broad utilization of the computer and automatic control in the third technological revolution enabled material production and social life in developed nations to become more and more deeply influenced by science and technology. After the advent of the so-called industrialized society, the number of people engaged in the third sector has become larger than the total number of the people engaged in the first and the second sectors, and the 5-workday system was implemented (but capitalist nations have their internal problems, such as economic recession, inflation, mass unemployment in the United States).

Fourth, with the rapid development of modern science and technology, the economy, and society has widened the gap between developed nations and developing nations, and the development of each nation has not been balanced. Japan and Europe are catching up with the United States. Some developing nations are also trying to catch up with developed nations. This is because science and technology and the economy and society must be coordinated in order to maintain high speed development while superpowers like the United States and the Soviet Union both have even more serious limiting factors in their development. Certain developing nations are relying on the developing of human resources (labor and intellectual forces) or relying on the development of natural resources while maintaining political stability and while the government is tightly grasping economic buildup and emphasizing the development of science and technology. Their development of science and technology, economy and society is catching up in big strides.

Whether the characteristics and trends of modern science and technology described above have been analyzed and expressed correctly and clearly requires everyone to study together. Undoubtedly, the study of this topic is very important. It has a great practical significance in our buildup of the four modernizations.

3. We should study and establish long-range plans for economic and social development and develop the function of science and technology. The long range economic and social development plans in our socialist nation practicing planned economy are the blueprints for building our socialist modernization. They are the fundamental reference for establishing and implementing medium-range plans. In drawing up long-range plans, we must on the one hand consider satisfying the needs of social development that are reasonable and that are possible to realize, and on the other hand, we must consider the conditions of our nation's natural resources and the level of our nation's science and technology as a productive force. For example, our nation has a large population. By the end of this century, it will reach about 1.2 billion. Overly importing food from abroad is not possible. We must be basically self-sufficient. This requires developing the strength of science and technology to increase unit yield of currently available cultivated land and produce as much food grains as possible. At the same time we must fully utilize mountain land, grassland and water surfaces, implement the policy of macroagriculture and macrocosmic food grains, suitably change the diet of the people (more meat, eggs and dairy products and fruits). Second, as natural resources increase along with the rise in the level of science and technology, more wealth will be discovered. Kuwait is a clear example. The nation has a population of 1 million, the per capita average income reaches $25,000, ranking first in the world. I went to this country in 1966. At the time, it was still very poor. Later, it utilized foreign technology, exploited petroleum in the territorial waters, and in particular, it later nationalized the projects and nationalized the enterprises, raised the price of petroleum and became rich. We must also strengthen scientific and technological work, strengthen prospecting and the development of resources, and include these efforts in long-range and medium-range plans for economic and social development under the condition that economic gain is concretely realized.

Efforts to establish long-range plans for economic and social development must also correctly solve the problem of rational development of the economic structure and the technological structure. By the end of this century, it is hoped that per capita income will be $1,000, i.e., and the gross national product will reach $1,200 billion. The plans to multiply the two productive values must be realized in 20 years. What then should be developed as a priority? If China wants to realize the four modernizations during these 20 years, it must carry out a technological revolution. How then should the tasks that have been solved by the three technological revolutions in world history and the various types of technological structures of manual labor, mechanization, semi-mechanization, automation and semi-automation at different localities during different times (in technological structure, even including different professions, different units and different jobs) be arranged so that the maximum economic gain can be realized? All these need to be studied profoundly.

As the Central Committee has pointed out, science and technology have many branches and they should serve the various sectors. Basic research should not be weakened, and they should mainly serve economic buildup. The question is that our nation's scientific and technical teams are divided among production, the national defense industry, regional scientific research agencies, universities and the Chinese Academy of Sciences. They all mainly serve economic buildup, but we also need to profoundly study what is the proportion of basic

research, applied research, developmental work, popularization of applications, scientific and technological service in scientific research work carried out by the various sectors before the entire function of our scientific and technological battlefront can achieve the highest efficiency.

4. We should study the comprehensive utilization of science and technology to develop production. This problem is actually the problem of how to realize the four modernizations. Developed nations have gone through several hundred years of evolution. They have formed their own national scientific and technological system on their economic foundations and under their social conditions. In these nations, as science and technology are more finely divided, how science and technology form a whole and how they develop their greatest function in economic and social development are spontaneously regulated by the economic laws of capitalism. The situation in our nation is completely different. Before liberation, our nation was basically a semifeudal and semicolonial society. Science and technology were very backward. After liberation, the main portion of our nation's large industries and scientific research was introduced or learned from abroad in a parallel manner, and the two did not combine well. In addition, we implemented centralized authority and command type planned economy, and for a long time we committed leftist mistakes, unified procurement and contracted sales, eating from the big pot, not talking about economic gains, the economy lost its internal power to utilize and promote science and technology. Scientific research itself progresses in many directions simultaneously like 10,000 arrows being released together. A complete scientific and technological system that was coordinated with economic and social development did not form. Therefore, although our nation's science and technology did realize some major inventions and creations, but most were singular efforts and they could not produce a major effect upon the national economy. Therefore, although it is important that our nation's scientific and technological -battlefront create new theories and new technologies, it is more important to comprehensively utilize science and technology to solve the problems of regional professions and major development in production. The Chinese Academy of Sciences and the provincial committees of Heilongjiang, Hebei, Ningxia and Hunan established five comprehensive scientific experimental bases (counties) for agricultural modernization on a trial basis. They did it this way. After 4 years of experiments, the five counties of Hailun, Luancheng, Yanci, Guyuan and Taoyuan did not invent or create any new technologies. Efforts involved only the comprehensive utilization of currently available science and technology in treating the farm village economies of the five counties as a whole. All efforts have realized achievements in stages. They summarized experience and determined the guidelines for agricultural development in the next 5 years: 1) The unit yield of agriculture, forestry, livestock production, sideline production and fishery should reach the higher levels of similar regions; 2) The per capita income should reach the advanced levels of similar regions; 3) The total value of agricultural production should increase by more than 5 percent per year (actually each province increased this by more than 6 percent); and 4) The ecological conditions should be improved, such as increasing the area of coverage by forests and grass, soil fertility should be gradually improved, the organic content in soil should be increased year after year. We believe these can be achieved. These cases explain the great potential of comprehensive utilization of science and technology. I believe this serves a

definite function in indicating to us how we should realize the four modernizations. This point is worth continued study.

IV. We Should Further Develop the Study of Science of Science

At present, the science of science has just begun in our nation. There should not be too many branches. I believe it should mainly learn and digest the achievements of foreign research in the science of science, clarify how we can hasten the development of our nation's science and technology and how we can better develop the function of science and technology in stimulating economic and social development. We must build a science of science possessing our nation's unique characteristics in the theoretical research and application of science of science. For this, I feel we should grasp tightly the following aspects of work:

1. We should develop basic research and applied research in the science of science. This means we should first study the history of development of recent and modern science and technology and foreign science of science, grasp the general laws of scientific and technological development, i.e., the laws of human understanding of nature and the laws of man's understanding of nature as a social movement. This can be said to be basic research. Then, we should study clearly the special laws of science and technology in China's development. The latter can also be said to be a kind of applied research. Without an overall understanding and an understanding of the history of science and technology without an in depth exploration of the general laws of scientific and technological development and the special laws in China, then when we encounter problems in scientific and technological development, we will handle the situation as it comes and this will never solve the problems. Without theory, this field of science of science cannot be developed.

To divide the work, to realize cooperation and to study science of science in depth, some comrades have already separately studied scientific policy, scientific and research management, scientific economics, scientific manpower and theoretical science of science, and they have already held an academic meeting on special topics. I believe that better results will be achieved if such efforts develop and persist.

2. We should form a research team. Scientific practice is the foundation for the emergence and the development of science of science. Abroad, there are many people engaged in research in the science of science. They have joined the profession after conducting research in natural sciences, the history of science, philosophy, economics, sociology and scientific research management. Our research team in science of science is the same. This specialized team is still forming at present and there are few people. But the leaders at each level are emphasizing the function of science and technology and will surely support the development of science of science. Because science of science is the theoretical explanation of the creative labor of the broad numbers of scientific and technical personnel, they will love and protect and nurture science of science. From the broad number of scientific and technical personnel will emerge many activists in science of science and semiprofessional and professional researchers. We must rely on the higher leadership and the

activists among the broad number of scientific and technical personnel to push forward the development of our nation's science of science.

3. We must tightly grasp the data and information of science of science and their publication work.

The final goal of research in the science of science is to develop science and technology. But it directly studies the laws of thought in man's understanding of nature and the laws of the social movement of man's understanding of nature. Its research method is basically the same as that of social sciences. It does not need laboratories but the indispensable data, information and libraries that are the basic raw materials for research in science of science. We now have briefs, special publications and special newspaper columns, but we lack specialized data, information, histories of foreign science, Chinese translations of famous works on the science of science and such works written by Chinese. We must conscientiously and concretely do this work. This is a basic condition for carrying out research in our science of science.

4. We must strengthen international academic exchange.

We must actively participate in international academic activities and absorb foreign research achievements to hasten the development of our research work. Exchange is reciprocal. Only if we ourselves reach a definite level and carry out exchanges will we be noted by foreign friends and be able to exchange findings in depth. We cannot just go and listen, we must use our work to meet friends and to make friends with foreign scholars in the same field. For this, we must grasp foreign languages. Relying on translations to conduct academic exchange will not work.

5. We must insist on the guidance of Marxism-Leninism and Mao Zedong Thought. We have now entered the internal arena of science and technology. Our nation is implementing the open door policy. The lifestyle and the corrupt ideology of capitalism have brought about a definite influence in our nation. In international cooperation in science of science and other sciences and technology, we must realize that our friends are all over the world. There are many foreign colleagues who are friendly to our people and who truly want to support our buildup of the four modernizations. But on the other hand, we must also see the corrupt functions of capitalist politics, economics and culture and there are even traps awaiting people who have lost political alertness. We must be armed with Marxism-Leninism and Mao Zedong Thought, love our socialist motherland, insist on sacrificing ourselves for the people's science, talk about scientific morality, establish a good scholarly atmosphere, and be proud sons and daughters of the Chinese nationality.

Science of science is a comprehensive science. It includes the content of natural sciences and the content of social sciences. The basic viewpoints of dialectic materialism and historical materialism must be the guiding thoughts and the foundation of methodology in our research work. I believe the Chinese Academy of Sciences has two unique characteristics. One is that it seeks truth from facts and serves the buildup of socialist modernization. The other is that it takes Marxist ideology as the guide. During this new era of building socialist modernization, as the economy is readjusted, reformed, reorganized and

improved, science and technology will develop their important function more and more. This is the glorious and actual situation. After the Sixth Plenum of the party, our party's Central Committee has completed the task of bringing order out of chaos in guiding technology. The scientific system of Mao Zedong Thought has again shown its brilliance. We are fully confident in foreseeing that in the march of the Chinese people toward rebuilding nature under the guidance of Marxism-Leninism and Mao Zedong Thought, our research in science of science will ride the waves and travel 10,000 li!

[Remarks] The several paragraphs on the trends in the development of recent and modern science and technology were added when rearranging the speech. The discussion of the second technological revolution was based on the paper "The Road of Technological Revolution and the Laws of Technological Economies" ("Science of Science," No 6, 1981) by Comrade Chen Ping [7115 1627] of the China Science and Technology University.

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SCIENCE PROGRAMS PREDICATED ON NEEDS OF ECONOMIC DEVELOPMENT

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese
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[Article by Guan Weiyan [4619 1919 3508] of the Physics Institute of the Chinese Academy of Sciences: "Scientific Programs Must Be Formulated Based on the Needs of National Economic Development"]

[Text] Recently, the Working Conference of the Central Committee decided on the major policy further to adjust the economy and to realize further political stability. In implementing this policy, science and technology should develop in coordination with the economy and society, and the promotion of economic development should be the foremost task.

When the State Planning Commission draws up long-range national economic development plans, it should include programs for the development of science and technology as part of the plans. It should also include scientific programs as programs for developing the national economy. This means scientific programs should be formulated according to the needs of national economic development so that the two can be organically and closely combined. In national economic development, a relatively fast rate of development can be realized only if we self-conscientiously utilize the newest scientific and technical achievements. Scientific endeavors can become prosperous and persist only when social needs serve as the driving force.

The key issue is that the state planning agencies should regard scientific and technical programs as their own affairs, place these programs under their control and exert efforts to use these programs to serve national economic development. If the planning departments merely provide a certain amount of funds for scientific research each year but do not assign tasks to the scientific research departments and do not inspect the results of such investment, then, scientific research and the needs of national economic development would be disconnected.

During the feudal era, natural science was not allowed to be widely and meaningfully applied in production because feudal production was based on manual labor of farmers and craftsmen. Farmers and craftsmen based their own labor on personal skills and skills acquired through experience and their knowledge of natural science unrelated to scientific theory.

When the feudal society changed into a capitalist society, the role of science changed. While pursuing profits, capitalists already learned to apply natural science in production. Capitalism made science serve it, and changed science from being the servant of theology into a slave of capitalism and a tool to enlarge surplus value and to pursue surplus profit. During the beginning period of the emergence of capitalism, the capitalist class decided to join the sciences in an uprising to oppose the church. Because of the influence of the capitalist class in creating profits in production, a new organ to study nature was born in Europe--the scientific academy. Rules of some scientific academies clearly stated that the most important task of a scientific academy was to promote the development of "mechanical skills" (i.e., technology). For example, the "minister of finance" of Louis XIV of France, Jean Baptiste Colbert, who became famous for his policies to protect capitalist industries and develop trade was at the same time a founder of the French Science Academy. This fact did not occur by chance. He specifically used to asked scientific workers to develop sciences that could promote the development of national industries.

As capitalist production developed, the capitalist class sought more and more help from natural sciences. When it was necessary, they were willing to spend huge amounts of funds to build laboratories and special academies for physics and technological sciences. Some large enterprises of capitalist nations have relatively large research and development departments. For example, IBM of the United States and the Bell Telephone Company all have large laboratories, and their research achievements are known worldwide. But more importantly, the research plans of these laboratories are formulated directly according to the needs of developing the companies' production and they directly serve to improve the companies' competitive capabilities. The results of a close combination of production needs and scientific and technical research are visible. The production of capitalist society is disorderly and chaotic, but the internal structure of every enterprise is highly organized and precisely planned.

Our socialist nation can apply those things that are effective in the internal structure of the individual enterprises of the capitalist world in the whole society so that scientific plans of the state can be self-conscientiously included in the needs of national economic development. In fact, only socialism can free science and technology from the yoke of capitalism so that they can be changed from a tool for profiteering to a means to increase the material welfare of the laboring people.

It is only possible to assure that scientific and technical plans are backed by the needs of national economic development when the state planning departments organize teams, draw up and monitor scientific and technical programs.

Scientific research can be divided into near term, medium term and long-range projects according to the period required for them to serve a function in production. In long-range plans, some medium term projects should be emphasized, i.e., those projects which could serve a function in production within 10 to 20 years.

Take energy as an example. Controlled thermonuclear fusion is a hopeful way for mankind to solve fundamentally the problem of the depletion of energy. But it is a long-range project and it will not produce any economic gain within about 50 years. Therefore, our national strength and the technological preparations of the past still cannot appropriately include this as an emphasis at present.

Nuclear fission power stations are medium term projects. They already generate over 10 percent of the total amount of electric power in industrially advanced nations. It is estimated that by the year 2000, the proportion of electricity generated by nuclear power throughout the world will surpass 30 percent. More than 20 nations in the world already have nuclear power stations while it is still a blank in our nation. Our nation already possesses a fair amount of technical reserve for such medium term projects. As long as we conscientiously plan the economic effects that may be possible during the next 5 to 10 years, we should include these projects as key projects.

Again, for example, the utilization of solar energy can also be feasibly realized in the near future. It is also a medium term project which does not require a large investment and which can produce quick results.

During the 1950's when the Soviet Union led in satellite technology, the United States reexamined itself and discovered that its weakness was in materials science. Therefore, it decided to establish over 10 materials research centers. As a result, it overcame its own weakness, and it enabled space technology to rapidly catch up and surpass the Soviet Union. Material science is related to all sectors of the national economy. And the continually emerging new materials in the international arena have become the most important material foundations of new technologies. We should select some projects that will produce medium term gains, organize forces and make breakthroughs in key areas.

Under the present situation created by the major decisions of the Central Committee, the scientific and technical battlefront should also implement the policy of further adjustment. It should review and examine current scientific research programs and plans. First, it should grasp those projects that require less investment, less time and that will produce quick results. Funds should be appropriated according to the tasks and the execution of the projects should be effectively monitored so that the investment can produce results. The effort should not be as it sometimes was: "Throwing money into the ocean, not even a sound could be heard." Secondly, in long-range plans, we should selectively grasp several medium term projects, organize forces, and make breakthroughs in key areas. I agree entirely with the policy of replacing efforts of enterprises to develop potential, renovation and improvement at an important position. But, to realize the miraculous "economic takeoff" experienced by some nations after the war, we should emphasize the use of the newest achievements in modern science and technology even more and to catch up with the others from a starting point at a higher level.

When Lenin analyzed the capitalist world during the era of imperialism, he pointed out the law of "latecomers surpassing the old timers." It was because

of this law that led to demands for redividing the colonies and war among imperialist nations. One of the reasons for "the latecomers surpassing the old timers" was that the latecomers did not carry the burden of outdated technology and they could freely use new technology. In industrial buildup, we should use the newest achievements in modern science and technology as much as possible while emphasizing technical improvement of existing enterprises. We should use new technical equipment and all methods to change fundamentally our nation's backwardness in industry and agriculture so that our nation's shortcoming of having a "weak foundation" can be changed to an advantage of "not being burdened."

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SCIENTIFIC RESEARCH READJUSTMENT NECESSARY TO NATIONAL ECONOMY

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[Article by Yang Jike [2799 4764 3784], professor at the Chinese Science and Technology University and deputy governor of the People's Government of Anhui Province: "Efficiency of Scientific Research Must Be Improved"]

[Text] During the period of readjusting the national economy, scientific research must also be readjusted correspondingly. Because national economic development often makes demands upon scientific research and because scientific research must first satisfy the needs of national economic development, therefore, readjustment of scientific research work in reality is an important link in the readjustment of the national economy. Without such readjustment, scientific research will not be able to combine with the national economy well, and it will go against our nation's situation and will hinder the realization of the four modernizations.

Readjustment of scientific research involves many subjects. Here, we will only talk about a few general views concerning one of the problems--improving work efficiency. A comparison of the funds our nation has spent over the years in scientific research and the achievements realized shows that the efficiency is not high. In some fields, it is even very low. If our scientific and technical circles can think of ways to improve efficiency with one heart and soul so that one man's achievement is worth two men's achievements, and the work that takes 2 hours to complete now can be completed in 1 hour, 1 square meter of space can be used as the 2 square meters of space required now, the utilization of one instrument can equal that of two instruments, then, scientific research will be able to improve at least fourfold instantaneously without increasing investment in capital construction, instruments and equipment. This is not empty talk. The key is conscientious and concrete work. The key to concrete work is to exert efforts to discover the potential of man, time, locality and materials so that they may be fully developed.

In developing human potential, we must first develop the potential of the group. In our nation at present, there is a serious imbalance in the distribution and assignment of manpower groups. One of the reasons that many talented people cannot develop their potential is that the groups to which

they belong are overly crowded. But, the fields in which they can develop their potential in a great way are barren and there is a lack of gardeners.

Such an imbalanced distribution and assignment of groups can be explained by two cases. One: We have recently learned from the founding meeting of the Second Light Industry Society in Anhui Province that the subordinate units of the Second Light Industry Department of Anhui Province has 160,000 people. Those possessing special knowledge constitute only 0.31 percent, a pitiful trifle. A reading of the topics of the academic reports showed that although many are beneficial to the economy, the number is also pitifully small. How can such a weak technical force enable light industry to realize lengthy and full development? How can we truly place light industry at an important position? But, the scientific research units in national defense have a gathering of talented people and university graduates are as numerous as the crucian carp swimming in the river. According to rumors, there was a couple who graduated from the department of electrical engineering at the 708 Institute. During the Cultural Revolution, they were persecuted and sent to the villages. They helped the production brigade of the commune in the farm village buy leftover bits and pieces of industrial material from the factories and taught several intellectual youths to make small electric motors which realized a profit of 200,000 yuan a year. The production brigade of the commune regarded them as indispensible and each month it gave them an additional 140 yuan in wages. After bringing order out of chaos, the 708 Institute invited them back to the institute and even allowed their promotion and raised their wages. Both of them wanted to remain in the farm village and were not willing to return to the institute. If they returned to the institute, they figured that they would be reserve personnel or redundant personnel, and like most other university graduates, they would not be able to develop their potential. Can we suggest that the scientific and technical personnel of the units subordinate to the National Defense Science Commission be readjusted so that a large number of them can be assigned to serve in the civilian light textile industry, electronics industry, electrical engineering industry, machinery industry, and chemical engineering industry which urgently need talent? The National Defense Science Commission places a lot of emphasis on systems sciences. If it can use the methods of systems science to study the problem of unified planning and utilization of the nation's scientific and technical talent, then it will surely not oppose this suggestion of mine.

Another thing: This year, Anhui Province invited experts of 15 disciplines to the northern and southern regions of the Huai River and western Anhui to inspect the comprehensive utilization of natural resources. This required the use of systems science to carry out comprehensive economic research. We invited a mathematical lecturer who knew the field to join the work. By chance we asked: How many teachers in your school's mathematics department are engaged in mathematical research that has practical uses in the national economy? This lecturer thought about it for a long time and said except for himself nobody else was interested and all were involved in abstract mathematics. At the same time, a comrade who had just returned from an inspection tour of the United States told me that the mathematics department of the state university he visited had 25 professors and 20 of them taught applied mathematics and concurrently engaged in scientific research, 5 professors taught

abstract mathematics, but they also were involved in applications research at the same time. This is because, only by engaging in applications research can they obtain extra compensation under contracts from enterprises. This is a comparison that is worth thinking about.

I believe, to readjust the imbalance of manpower between the "roads," the government should study and develop truly effective policies so that manpower can move toward a direction of joining with national economic needs under a controlled manner. To readjust the imbalance of manpower between abstract theoretical studies and practical applications, the government should study the policies of combining planned adjustment of manpower and market adjustment. Otherwise, the imbalance of manpower groups will continue to develop. This obviously is unfavorable to national economic development and the building of the four modernizations.

The second aspect in developing the potential of manpower is to develop the potential of the individual. For this, the urgent task at present is to implement and popularize the 16-character policy of "single project management, division of responsibility in levels, criticism and evaluation by peers, signing of contracts." According to reports by comrades who had recently worked at the Massachusetts Institute of Technology in the United States, the professors at that school are all concurrently involved in scientific research tasks commissioned by industries and mining enterprises, various social organizations and the government. Most use the contract responsibility system. The goals, funds and times are all fixed, but the professors signing the contract are responsible for how to utilize the funds and time including the hiring of workers and purchasing or processing instruments and equipment. In this way, funds are conserved, and only those instruments that are necessary and sufficient are purchased. Competition among experts is keen and they fear losing the next contract. Every worker works hard. This management method not only forces the direction of scientific research to be combined with the practical needs of industries, it is also a strong driving force behind every individual. It makes them have a strong sense of responsibility and they utilize every minute and second in their work and their efficiency is very high. In this way, the mobility and the potential of people are all fully developed, and their upward and downward mobility depends entirely on the level of their achievement. Seniority is not adhered to. To say that one of them equals two of us may be an understatement.

There is also a lot that can be done in the effective utilization of time. If the method of unified planning proposed and popularized by Prof Hua Luogeng [5478 5012 1649] is used in scientific research, a lot of time can be saved. I have seen laboratories for chemical analysis at several research institutes but frequently I do not see a large number of ordinary flasks that have been washed, such as test tubes, beakers, syphons, droppers, fractional distillers, etc. It can be imagined that such an analysis laboratory surely is not highly efficient in the utilization of time. Experiments must be like an operation performed by a surgeon on his patient. All tools, knives, scissors, tongs, needles, saws, etc., must be washed, wiped, sterilized and cleaned and placed orderly in the tray beside the operating table for one nurse to hand them over to the surgeon for use. The doctor should concentrate all attention on

the site of the operation and he does not even turn his head when asking for tools. Only in this way can the entire operation be performed within the shortest time. The efficiency is the highest, and the safety of the patient can be most completely guaranteed. The situation in chemical experiments is the same. If a tool has to be sought when it is needed, and then washed and cleansed in distilled water for use, won't precious time be wasted? This is really a pity. This seems to be a very insignificant thing, but it has a profound meaning. Because, if every procedure of every scientific and technical experiment takes into consideration how to conserve time, very quickly, a double amount of work can be done with half the effort. Therefore, I believe every scientific researcher, especially comrades leading the scientific research project groups, must learn the scientific methods of saving time and manpower, such as the method of unified planning. We must conscientiously study how to develop the potential of time.

In management, we must reward those who save time and punish those who waste time. In the past, the various unreasonable political labels such as "being a pure specialist" and the unshaken "permanent appointments" have created an actual result of punishing those who saved time and those who worked hard and correspondingly awarded those who wasted time, therefore, all of these were not scientific management methods. They are contrary to the goal of improving efficiency. To seek rapid progress in scientific research in such a way is trying to go south by driving the chariot north! If we can quantitatively survey and compile statistics on the distribution of the time required to accomplish various types of scientific and technical research tasks and predict the longest time required for similar types of scientific research tasks with a believability rate of 95 percent and fix the scheduled period by contract, then, we will be highly confident in completing the tasks on time or ahead of schedule, and we will surely improve the efficiency of time utilization greatly. If we use the method of rewarding and encouraging efforts to save time, then, the gain will not simply be doubling the accomplishment with half the effort.

There is also a lot of potential that can be developed in the use of space in our nation's scientific and technical research academies and institutes. The area effectively used for experiments at each research unit is generally smaller than that in foreign nations. Comrades who have visited foreign nations all know that laboratories in foreign nations are all very crowded, and scientific and technical personnel do not have office space. There are few managerial personnel. Therefore, the area occupied by offices is also very small. Frequently, to utilize space most effectively, it is common to carry out several research projects in the same laboratory. Cabinets line the walls everywhere in order fully to utilize space. In contrast, some of the research units in our nation have too much office space and some are even very spacious. Some laboratories have a very low rate of space utilization. Many lab tables are not used for a whole year but a lot of instruments and equipment that are never used are stored there like a museum of instruments. In our nation, it is rare to conduct several research projects simultaneously in one laboratory. And very few people have conscientiously studied how to utilize most effectively every square meter of space but many people ask for new buildings. If we conduct a study and a survey we will discover that the research laboratories

and groups often mark their boundaries clearly and they do not cross these boundaries. Because of the rampancy of the incorrect ideas of doing everything in a big way and "occupying" one branch of science, the laboratory group and the group circle at the research institutes believe the bigger the better, and the more space they occupy the better. As a result, the effective utilization of space in the buildings necessarily drops by a large amount. The faults created by this type of purely administrative method can be seen. A detrimental result thus created is that the efficacy produced by the investment in capital construction spent by the state is not high. Therefore, during this period of readjustment when hundreds of professions await development, readjusting the efficiency of space utilization at each scientific research unit and readjusting the management system are necessary. The method of readjustment is to use the method of combining economic management and administrative management on the basis of a general survey of the actual use of space at the localities. For example, fees can be levied on space which is not utilized. The criteria for such fees should increase in the degree of intensity of the space actually in use. In this way, each research laboratory group is forced to convert office space into laboratories or effectively utilize space that is not used, or let persons engaged in other important research projects use the space. If such economic management methods are used, it is entirely possible for the whole nation to develop potential space constituting 30 percent of the total without increasing the investment in capital construction of scientific research. Some localities can even develop potential space reaching 50 percent.

The potential of instruments and equipment is even greater. The survey of the nation's large computers this year fully explains this problem. Up to May of 1979, 332 large computers have been imported at a cost of $326 million, equivalent to nearly 500 million yuan renminbi. But, the rate of utilization is only a fraction of the effective operating time of 20 hours a day in foreign nations. Less than one-third of the computers operate up to 10 hours a day. Anhui Province has 234 large computers, only 3 operate over 8 hours a day. Even so, some units still insist on continued importation of large computers. If we investigate further to see what the projects are that run on the computers operating for more than 8 hours a day, we will often find that the proportion of important subjects related to national economic development is very small. This is so for computers, and it is also the same for other expensive imported instruments! Foreign scientists who have visited our nation have praised the sophisticated instruments displayed at some research institutes (please note, their rate of utilization is all very low) because they cannot afford to buy them! The director of the Laser Research Institute of the famous Max Planck Society in West Germany came to China to discuss cooperation in laser research. He said that the instruments seen in our institute were more sophisticated than the ones in his institute. Whether this is praise or a derogatory remark, it is difficult to tell!

The common phenomenon of a low efficiency of utilization and a low economic gain of such instruments and equipment is also contrary to the demands of our national economic development. I suggest that during the years of readjustment, we should conduct a general survey of all instruments and equipment valued at over 10,000 yuan throughout the nation. Necessary policy

readjustments should be made on the basis of this general survey, including policies governing the importation of instruments and equipment and management policies, and a whole set of economic measures should be taken to strengthen control and management so that each object can be fully utilized. For example, those instruments and equipment that are not being used can be taxed by levying an investment tax to force them to be used effectively and to be combined closely with the scientific research projects needed in industrial and agricultural development and national economic development. Those large instruments that can be shared or centrally utilized such as computers can be intensively utilized effectively, not letting them remain scattered, inefficiently utilized and idle. Such bad habits of blindly importing sophisticated instruments and equipment and going on a buying spree at year-end should be strictly prohibited. When necessary, laws must be established to seek legal responsibility for those who waste!

I do not know why, but everyone's eyes seem to be focused on export trade and foreign markets, while at the same time, the foreign exchange that does not come easily is wasted on some impractical sophisticated instruments. Several hundred thousand dollars are not even mentioned and even several hundred million dollars are spent without regret. I see that the time has come to turn the focus on the unpredictable foreign market in which we cannot yet compete to the vast domestic market and it is time to spend the precious foreign exchange on materials that have to be imported for national economic development instead of on expensive sophisticated instruments which are impractical in China.

Physiologists all know that the functional efficiency of the human organs is very high. The brain, the heart, the liver and the stomach all function with a high efficiency. The human body survives and progresses because of their highly efficient coordination. Scholars of bionics all know that the functional efficiency of any social mechanism will acquire vitality and will realize lengthy and sufficient progress if it imitates the efficiency of a biological entity. Of course, there are not exceptions in scientific research. The highly efficient union and utilization of manpower, time, locality and materials are like the highly efficient coordination of the organs of the human body, the brain, the heart, the liver and the stomach. The low efficiency in the utilization of human talent is like the retardation of the brain. The low efficiency in the utilization of time is like myocardial infarction. The low efficiency in the utilization of space is like hardening of the liver. The low efficiency in the utilization of instruments and objects is like the swelling of fat. If all four of these symptoms occur in the human body, life will end soon. In scientific research agencies, there will be intangible waste and no real results. For this, let us all call out: We must improve the efficiency of scientific research! We must include the readjustment of scientific research as an important content in improving the efficiency of scientific research. We must elevate the efficiency within 3 to 5 years to the level where it can be combined closely with national economic development, and we must elevate it to the level where it can correspond with the steps of progress of the four modernizations. We must seize every minute and second by being thrifty and by calculating carefully. We must develop the potential of manpower, materials, time and space and utilize them, and quickly shorten the distance between the level of China's science and technology and the world's advanced level.

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STRESSING SCIENCE, TECHNOLOGY IN ECONOMIC DEVELOPMENT

Beijing RENMIN RIBAO in Chinese 5 Apr 82 p 5

[Article by Li Jianbai [2621 0494 4101]]

[Text] The new policy on scientific and technological development formulated by the Party Central Committee is a momentous decision based on historical experiences as well as the only correct policy for China's science and technology.

That we have come to this conclusion is primarily because it is completely compatible with our national conditions and with the demands of our economic construction and social development. As shown by our experiences since the founding of the nation, especially in the past 3 years, we must, in China's socialist construction, change the old practices under the "left wing" ideological guidance, start truly from our practical conditions, and follow a new path which is more realistic in speed and better in economic benefit and which gives the people a greater material benefit. With the basic change in the economic construction policy, one should say that science and technology, as productive forces, have made great contributions in promoting the development of the national economy. However, we must also realize that, for a time in the past, many urgent problems were found in the focal points of scientific and technological development and in the management system, e.g., the lack of close integration between scientific and technological and economic developments; the stress on level in certain studies while overlooking the results, and inadequate attention on the production of consumer goods; the lack of smooth channels among research, trial manufacturing, production and application; the lack of necessary coordination in scientific research between the military and the civilian and among the various civilian systems, the dispersion of strengths and the duplication of tasks; the inadequate digestion of imported technology and the lack of innovation, etc. If these problems are not basically solved, science and technology will not fully develop their promotive effect on economic construction. Conversely, the lack of improvement in the economy and of funds and conditions will also impede the development of science and technology. Therefore, while the new policy answers the need of the basic change in the economic construction policy, it will also promote the coordination of science and technology with the economic and social developments.

Next, the new policy is also compatible with the laws of economic and scientific and technological developments. Whether industry or agriculture, or any other field, modern production is all a product of science and technology, or, one might say, the materialization process of science and technology. Science and technology, as an active element of the productive forces, are playing an ever greater role in the economic growth. The conditions of the major economically developed nations in the world indicate that, at the beginning of this century, their economic growth was achieved mainly by means of enlargement and extention. In other words, the growth was achieved by increasing the equipment, enlarging the investment and enhancing the labor force. After the thirties, especially after World War II, it has been mainly by means of science and technology. We were not very conversant of these facts. The moment developing production was mentioned, it meant setting up a big display, launching capital construction and reproducing the obsolete technology, and we paid for the mistakes. This lesson must be well assimilated. In terms of the development of science and technology, there is also the issue of the goal which calls for solution. In scientific research, naturally we want to explore the unknown, catch up with and surpass the advanced, create more results and train more talents, but the most basic thing is to raise the productive forces and promote the economic and social developments. Apart from this basic goal and from the needs of economic and social developments, scientific research will turn into a sourceless water and rootless tree.

Today, there are many reasons for the failure of China's science and technology to develop their role fully. The development and application of science and technology are determined by the demand of society. However, this demand is usually only a latent necessity. To turn it into reality depends, to a large extent, on correct policies and on the understanding of the role and position of science and technology on the part of our leading comrades of the various levels. Summarizing the past and examining the thinking of our leading comrades, we find that our understanding of science and technology is indeed inadequate. There are also many incorrect things in practice, which are concentratively manifested in two aspects: lack of harmony between scientific and technological development and the development of the national economy; neglect of the role of the scientific and technical personnel, making it difficult for them to give full play to their expertise. After the downfall of the "gang of four," especially since the 3d Plenary Session of the 11th Party Central Committee, the understanding of the importance of science and technology has gradually improved. But, to give them their proper position in the modernization construction requires that our leading comrades of the various levels further raise their consciousness and perform much concrete work. We must realize that today, if we still fail to understand the importance of science and technology and to coordinate them with the economic and social developments, it will no longer be a simple problem of the leadership and work methods, but a momentous issue of whether we can accelerate the building of a modern socialist power. Hereafter, if we give no serious attention to science and technology, but remain shortsighted and stick to the old ways, we will pay even more dearly and commit historical errors.

To fully develop the role of science and technology in Heilongjiang Province during the 6th 5-Year Plan is to give full play to the superiority of our

province, tackle properly the key problems in science and technology, spread the scientific and technological achievements which are large in volume and wide in area and which produce marked economic benefits, and seek to make the factor of scientific and technological progress play one-fourth to one-third of the role in the economic growth.

1. Actively develop research work by centering on achieving the strategy of agricultural development. To build our province into a modern agricultural base with commodity grain as the key and overall development of economic crops and diversification, and gradually realize the "three-three system," we must organize a comprehensive survey of our natural resources and an agricultural, industrial and commercial economic survey, and formulate a scientific overall plan on agricultural divisions and land utilization, in order to rationally develop and utilize our natural resources and provide the basis for agricultural modernization. Currently, we particularly need to achieve noticeable results in cultivating and spreading superior varieties, remolding the farming system, improving the low-yield soil, properly handling the crop layout, changing the structure of chemical fertilizers, introducing rational fertilizing, producing insecticides of high efficiency and low residual poison, and selecting complete sets of farm machinery.

2. By actively developing studies of technology on consumer goods production. We must promptly readjust the service direction and the composition of products of the machine industry, and study and manufacture suitable advanced technical equipment for light and textile industries, food processing and the building industry. We must fully utilize the superiority of our natural resources and concretely promote the comprehensive utilization of lumber, beet, flax, soybean and corn. We must study and develop new textile products using flax, wool, silk and chemical fiber as raw material, master promptly the techniques of handling subsequent to dyeing and arranging, improve the quality of chemical fiber products and increase the designs and varieties. We must study and produce concentrated, convenience and children's foods of high nutrition, superior quality and low cost, develop the microbial fermenting technique, and carry out the study of nutritive composition. We must study and manufacture new type building materials and components and provide advanced technology to increase the output of cement, glass and ceramics.

3. Actively develop studies on the techniques to develop and conserve energy by centering on solving the energy shortage. To solve the energy problem, we must, in the long-range view, stress development and conservation equally; in the short-range view, we must give priority to conservation. Heilongjiang is one of the coal and petroleum bases in the country. We must stress the study of the new oil mining technology, assuring the sustained high and steady yield of the oil fields, and improve the comprehensive mechanization level of coal mining, greatly enhancing the coal output. In energy conservation, we must vigorously study and provide new technology, material and equipment for conservation and develop the techniques of coal gasification and comprehensive utilization of inferior coal. Solving the rural energy problem, an urgent task today, must be given preferential consideration. First, we must organize forces to work out rural energy divisions in areas with firewood shortage and, in accordance with the principle of consideration of local conditions,

supplement each other in many areas, comprehensive utilization and practical benefit, plant fuel forests, promote methane production and small hydroelectric stations, while actively utilizing solar and wind energies, and form a rational energy composition.

4. Studying and solving the crucial technical problems by centering on developing the potentials of existing industries. To develop the potentials of existing industries by means of technological remolding is a strategic measure to achieve the beneficial circle of production. In technological remolding, we must start from reality and gradually form a rational technological composition. It will be impossible, within a fairly long period of time, for all the industries to adopt the newest technology and one-sidedly seek automation. We must integrate the overall technological remolding with the minor remolding of a part of the equipment, technology and products. We must focus on improving the economic benefits, conserving energy and raw and processed materials, reforming the products structure, and rationally utilizing resources, and consider quality improvement, cost reduction and higher production of marketable products the main targets. We must fully develop the superiority of the machine industry of our province and serve the technological remolding of the national economy.

5. Introducing scientific and technological achievements in large areas over a wide range by centering on improving the economic benefits. According to incomplete statistics, Heilongjiang, since the founding of the nation, has made a total of more than 6,000 achievements and imported a number of new techniques from abroad and within the country. Military production also contains many advanced techniques and technology suitable for civilian use. All these are ready-made productive forces and valuable assets already in hand. So long as they are conscientiously introduced and applied, they will produce a great economic benefit.

6. Properly handling the technological reserves by centering on further developing the national economy. While developing and studying production technology, we must appropriately plan the study of applied theories. In agriculture, industry, medicine and public health, we must actively study such new technologies as electronics, computer science, atomic energy, laser and remote sensing and suitably launch research in genetics, growth and development theories, and control techniques. We must strive to make greater progress in the study of special semiconductor elements and semiconductor sensor parts, and in human reproduction and physiology.

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'RENMIN RIBAO' DISCUSSES PROMOTING SCIENCE, TECHNOLOGY

Beijing RENMIN RIBAO in Chinese 22 Mar 82 p 5

[Article by Hu Ping [5170 1627] and Deng Nan [6772 2809]: "In the Face of the New Situation--Looking Back on the Implementation in the Past Year of the New Policy for Scientific and Technological Development and Looking Forward to its Prospects"]

[Text] At present, an upsurge of relying on science and technology to promote economic and social development is in the making throughout the country. The strategic thinking of "economic and social development must rely on science and technology, and science and technology must serve economic and social development" is beginning to take root in the hearts of the people. Science and technology as an effective means of policymaking and as a powerful function of productive forces have become increasingly apparent in both the macro and micro aspects.

Since the founding of the People's Republic, several upsurges have appeared in the development of our scientific and technological undertakings. In 1956, following the development of large-scale economic construction, the first upsurge of the "march toward science" appeared in our country, and important results were achieved. Unfortunately, it was very quickly interrupted by the political movement which followed. The National Scientific and Technological Work Conference convened in Guangzhou in 1962 cleared up the "leftist" mistakes of the latter part of the 1950's and adopted a series of measures to consolidate and strengthen scientific and technological work. There was a new development in scientific and technological undertakings. However, the "Great Cultural Revolution" which began in 1966 again caused a new and greater setback to scientific and technological undertakings. The National Science Congress held in 1978 was a great turning point in the development of scientific and technological undertakings in China. This congress thoroughly criticized politically the long-standing "leftist" abuses which seriously fettered the development of scientific and technological undertakings for many years, implemented the party's policy for intellectuals as well as other policies and expounded the idea that science and technology is the Marxist principle of productive forces. This had a far-reaching impact on the development of scientific and technological undertakings in China. However, the inadequacy was that this congress did not directly link up the development of science and technology with economic and social development and did not put forward the effective

method and measure of relying on science and technology to promote economic and social development.

new policy for scientific and technological development put forward by the CCP Central Committee in 1981 hallmarked a new stage in the development of scientific and technological undertakings in China. The central idea of this new policy is to strengthen close integration and coordinated development between science and technology and the economy and society. Under the impetus given by this new policy for scientific and technological development, new changes have appeared on the scientific and technological front in the past year.

1. Many party and government leaders from the Central Committee to the localities have paid attention to further strengthening scientific and technological work. This kind of attention is no longer just verbal. They are beginning to regard the development of scientific and technological work as an important component in the development of strategy. Many districts and departments throughout the country have already integrated science and technology with the economy, and proceeding from the economic characteristics and industrial superiority of their own district and department, formulated an overall plan for the coordinated development of science and technology and economy. They have determined the orientation and problem of scientific research according to the needs of economic development, and at the same time, also relied on science and technology to tap latent productive capacity and to carry out a technical restructuring of the national economy. They have obtained definite results in getting resources, energy, quality, output and economic returns from science and technology. Facts have shown that the development of science and technology is no longer a less essential "soft" task, but it is a "tough" task capable of affecting the overall situation.

2. The broad masses of scientific research units as well as scientists and technicians have heightened their consciousness of serving economic and social development and have further defined the basic goal and orientation of developing science and technology. While steadily strengthening basic research, China at present has concentrated its main force on applied research and developmental research. Many units have readjusted the problems and items of scientific research, strengthened direct ties with production departments, accepted research tasks and assignments from production departments, supplied technical advice and service to the whole society and gradually developed the orientation of scientific research to meet the needs of society. This has not only effectively promoted the development of production, but has also stimulated the work of the units themselves.

3. The role of scientists and technicians in modernization is being further respected. They are not only bringing their specialities into play in such concrete work as scientific research, planning and production, but they are also playing an important role in the strategic policymaking of the whole district, the whole department and even the whole country. Some policymaking organs are beginning to pay attention to the views of scientists and specialists and carrying out a feasibility study before they adopt an important

measure. Some scientists and specialists with organizational and administrative ability have joined leading bodies at various levels.

4. There has been new progress in the popularization and application of scientific and technological achievements. As a result of implementing the principle of "four shiftings" (shifting scientific and technological achievements from the laboratory to production, shifting from advanced areas in the country to backward areas, shifting from military use to civilian use and shifting from outside the country to inside the country). The scientific and technological achievements of many places no longer remain at the "sample, souvenier and exhibit" stage but can now be more quickly applied in production. Many new forms of technical transformations, such as various forms of contract systems, compensative technological transfers, scientific research and production joint ventures, technical advice and services, and technical achievements fairs have been created in practice.

5. Great developments have taken place in the work of enterprise-run scientific research. After expanding the decisionmaking power of enterprises and setting up the economic responsibility system, many enterprises changed their longstanding tendency of neglecting the technical structure of the past and showed a greater interest in product and technical quality. According to the investigation of some provinces and municipalities, among the important technological achievements scored in 1981, about one-third to one-half were supplied by enterprise-run scientific research projects. State-run scientific research has distinctive characteristics and superiority and can quickly provide economic returns. Some of the enterprises, which were always operating at a loss, have quickly turned losses into profits and changed their features because of a breakthrough in technology.

6. A new upsurge in studying and applying science has appeared in the vast countryside. The agricultural production responsibility system has greatly aroused the demand of the broad masses of peasants for "scientific farming." Apart from the existing agricultural techniques stations in the countryside, there are now such new things as "agricultural science households," and they are playing a hardcore as well as exemplary role in scientific farming. In the past years, various measures have been adopted in many districts throughout the country extensively to popularize the achievements of scientific research in agriculture and notable economic results have been achieved. There is a marked improvement in the position of agricultural scientific and technical cadres and they are generally welcomed by the peasants.

7. The channels of scientific research funds are beginning to develop toward diversification. In the past, scientific research funds came under the unified allocation of state financial departments and the amount of funds had no direct connection with the economic returns of scientific research achievements. At present, the economic returns of scientific research achievements receive widespread attention from society. Scientific and technological investment has now become a "ten thousandfold profit" matter. The channels of investment have been increasingly diversified. Apart from unified state financial allocations, many localities, departments and enterprises have in varying degrees all squeezed out funds for scientific and technological investment. Moreover,

the additional income obtained by the scientific research units from the transfer of technology, supply of technical services and sales of scientific research achievements and trial-manufacture products has also become an important source of funds for the scientific research units.

8. There is a new way for the rational circulation of qualified scientific and technical personnel. Regarding the employment of scientific and technical personnel, apart from unified assignment by personnel departments, some localities have been experimenting with "rational circulation" within a given framework. Some have "invited applications" for technical guidance from scientific research units and institutions of higher learning. Some have formed "joint ventures" with provincial, municipal and enterprise research units and used outside scientific and technical forces to serve the production of their own province and municipality.

9. Large numbers of newly emerging medium-size and small towns, which relied on science and technology to quickly change their features, have appeared throughout the country. The 60 percent increase in profits and the 40 percent increase in output of some urban industries have been obtained from technical progress. These towns have one distinguishing feature in common, and that is they have really given prominence to scientific and technological work in modernization and have given an impetus to the whole economy and to the rapid development of industrial production in particular.

10. There have been great developments in the study of scientific and technical policies. Last year, China held two national conferences for the study of scientific and technical policies. At present, almost all provinces and municipalities throughout the country have set up organs for the study of scientific and technical policies. Quite a few districts and departments have set up research organs for the study of science. These organs and organizations have, on the basis of conducting a vast amount of investigation and study, put forward many important views and suggestions on implementing the new scientific and technical policies, restructuring our scientific and technical management system, studying our strategy for social and economic development and forecasting the trends of scientific and technical as well as economic development both at home and abroad.

Naturally, we should see that the implementation of the new policy for our scientific and technological development is only just beginning. There are still many problems and difficulties. After the implementation of the new scientific and technical policies, there will be corresponding changes in our scientific and technical management system, scientific research and planning system, scientific research funds management method and scientific and technical personnel management method.

In the face of this new situation, our comrades on the scientific and technical front hold that we must first grasp the following links:

Change the Outmoded Work Method of Responsible Scientific and Technical Departments

In implementing the new policy for scientific and technological development, there should be a big change in the leadership style and work method of the scientific and technical departments at various levels. They must break away from the former habit of limiting themselves to a narrow circle of departments and from the same old ways of administrative management and document reports. They must closely cooperate with other departments and grasp important problems relating to economic and social development together. Everything from determining economic targets, reforming the economic structure and deploying productive forces in a rational manner to surveying and utilizing resources in a rational manner, restructuring the technology of enterprises and drawing up technical and economic policies should be grasped. They must enliven their thinking, enliven scientific research organs and enliven activities for finding ways of making money for scientific research. They must grasp policies, coordination, industrial superiority, uniting scientific research and production and popularizing scientific research achievements. By means of investigation and study and the carrying out of guidance according to category, they must unify various tasks on the path of closely integrating science and technology with coordinated economic and social development.

Continue To Grasp Properly the Work of "Four Shiftings"

The carrying out of the "four shiftings' is the scientific summing up of both the positive as well as negative aspects of the experiences of our scientific and technological work in the last 30 or more years. The present question is how to quickly, effectively and persistently carry out these kinds of changes. This involves restructuring the economic system of the state and also involves the economic policy, tax policy, price policy, credit policy, technological secrets policy and patent right system of the state. At present, many forms of shifting have been created in various parts of the country. However, most of them are still at the primary stage. We must continue to improve them, theoretically explain them, systematically perfect them and set up laws to protect them.

Organize Forces To Make a Concentrated Attack on Science and Technology

At present, in the solving of some important scientific research problems, there are still such defects as duplication, dispersed manpower and lack of unified planning and coordination in many departments and districts. Experiences from both at home and abroad have indicated that in order to solve important scientific and technical problems, we must organize the forces of various sectors, rationally carry out distribution of labor and cooperate in making a concentrated attack before we can get double the result with half the effort. For the sake of organizing properly a concentrated attack, we must first select a number of projects; make proper arrangements for funds, materials and manpower; define responsibilities and strictly carry out periodic inspections. Not only key projects of a national nature must carry out work in this way, but some of the projects of a departmental or regional nature must also carry out work in this way. In the concentrated attack,

responsible scientific and technical departments must closely cooperate with the departments and units concerned and actively bring their organizing and coordinating role into play.

Actively and Reliably Carry Out the Restructuring of the Scientific and Technical Management System

Following the implementation of the new policy for scientific and technological development, certain contradictions in the scientific and technical management system have become more clearly exposed. The restructuring of the scientific and technical management system has become imperative. This kind of restructuring deals with a wide range of sectors including perfecting scientific research planning, expanding the decision-making power of scientific research units, implementing compensative technological transfer, perfecting the scientific research contract system, diversifying the channels of scientific research funds and using qualified scientific and technical personnel in a rational manner. Even though at present our country is still in the period of readjustment and all-round restructuring cannot be carried out, we should actively create conditions by beginning to restructure parts which are already matured, accumulate experiences and gradually popularize them. We cannot passively wait. If a unified method for the whole country cannot be formulated to solve some of the problems for the time being, we could formulate some provisional rules and regulation based on the actual situation of our own district or department to expedite the development of work.

Strengthen the Study of Scientific and Technical Policies

The study of scientific and technical policies is a kind of comprehensive research spanning departments and disciplines and involving the fields of politics, economics, society, science and technology, and education. Experiences in many countries have indicated that the study of scientific and technical policies has a very important bearing on the development of scientific and technological undertaking and on the coordinated development of science and technology, society and economy. Apart from the several problems mentioned beforehand, there are many problems we must study at present. A district or a department in particular must firmly grasp industrial superiority, key projects and their economic returns, explore correct ways of applying science and technology to promote development, really act as "brain trust" and "staff officer" to leading members at various levels and make contributions to scientific policy making.

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'RENMIN RIBAO' REVIEWS SCIENCE, TECHNOLOGY DEVELOPMENT

Beijing RENMIN RIBAO in Chinese 6 Jun 82 p 3

[Article by Liu Ying [0491 7336], vice president of the Central China Engineering College: "Several Questions on Developing Our Country's Scientific and Technological Work"]

[Text] In order to speed up our scientific and technological development, several questions on policy have to be studied and resolved.

1. Emphasis should be placed not only on the research work of the science academies and research institutes, but also on the significance of the institutions of higher learning as a front army of scientific research.

The First 5-Year Plan saw great development in higher education as faculties and departments were readjusted and new colleges completed. Some government departments, however, held a misconception that scientific research should be distinguished from the training of qualified personnel since science academies and scientific research institutes were responsible for scientific research, whereas institutions of higher learning were responsible for the training of personnel. Modeled on the Soviet Union's system, institutions of higher learning were distinguished from scientific research institutes upon the completion of science academies and other scientific research institutes. Consequently, the material conditions and funds of the institutions of higher learning for scientific research have been ignored for a long time.

Scientific research is mainly done at institutions of higher learning in some industrialized countries such as Britain, the United States, West Germany, Japan, France and Switzerland. Such institutions do not have large and independent science academies. Although Russia's science academies are distinguished from its institutions of higher learning, much importance is attached to cooperation. Many academicians are professors at institutions of higher learning. Other national scientific research units are closely related to institutions of higher learning. I paid a visit to the famous Max Planck Research Institute in West Germany and the West Germany material inspection headquarters in West Berlin in 1981. They have both established close ties with Stuttgart University.

Leaders of various departments in the research units are university professors. The laboratory facilities of the research units are open to university graduate students to write their research papers and to perform their experiments. The Government of West Germany pays much attention to the scientific research done at universities. I was much impressed by their concern in training young and talented personnel, the sophistication of laboratory facilities in their universities and the intensity of research work.

Our poor management in the division of science academies and institutions of higher learning has given rise to several problems. Older and senior technologists of science academies were mainly transferred from institutions of higher learning. They seldom taught at these institutions after their transfer, thus weakening the training of qualified personnel at institutions of higher learning. All or most of the advanced laboratory facilities are imported for research units and factories, because of an acute shortage of funds, the laboratory facilities of such institutions are obsolete and backward. Most of the facilities date to the early fifties. The backwardness of facilities not only hampers the development of scientific research, but also impedes the training of qualified personnel. Last year I paid a visit to universities in Britain, the United States, West Germany, and Japan. Most of the universities in these countries provide their students with electronic computers. The universities in Japan, West Germany and the United States have their largest and most recently developed electronic computers installed on the campuses. Until the end of 1979, our state had installed 300-odd large, medium and small electronic computers in scientific research units and enterprise units. Institutions of higher learning are seldom equipped with such computers. As a result, the students have great difficulty in learning to operate them. In fact, such computers are completely new to many university lecturers, and owing to a shortage of operating personnel, the rate of utilization of computers in research and enterprising units is very low. Other equipment and facilities also have a similar situation. Last year when I paid a visit to the Zeiss Company in West Germany, officials there told me that each of the most sophisticated, three-dimensional multipurpose optical testing instruments cost several hundred thousand German marks. China has ordered eight, but none are installed in the institutions of higher learning.

The institutions of higher learning do not have or have only very little funds for scientific research. The funds for scientific research within the 1981 operating budget of the Ministry of Education has only 1/20 of that of the science academies. The training test scores of doctors and teachers in institutions of higher learning examined and approved by the degree committee of the State Council were three times and five times better, respectively, than those doctors and teachers of the nationwide scientific research institutes. The shortages of material conditions for doing scientific research in institutions of higher learning has become more acute.

Faced with such difficulties, the teachers in the institutions of higher learning have worked energetically and scored remarkable results in scientific research under the guidance of the party. Quite a few items won the national invention award. In the past 2 years, some teachers from institutions of higher learning went abroad as visiting scholars. With the help of superior laboratory

facilities and computers, quite a few scholars scored remarkable results in scientific research within a very short time. The five inventions concerning hydraulic pressure by Comrade Lu Yongxiang of Zhejiang University at Essen University, West Germany, was only one of the examples of success which clearly shows that the institutions of higher learning have great potential in developing our science and technology.

Our science academies and other scientific research units have, of course, made great contributions to the development of our scientific undertakings. However, more scientific results would have been scored if our institutions of higher learning had been provided with better material conditions, since the manpower at our institutions of higher learning is 10 times that of the science academies. Furthermore, we have more than a million outstanding students studying at such institutions. The young people are quick-witted and innovative; these are the indispensable qualities for scientific research.

Through the scientific research done at the institutions of higher learning, the teachers come into constant contact with various scientific fields. They can improve their academic standards and enrich course contents with the latest scientific development. They can also help their students study in a scientific atmosphere, develop their innovative power and research potential and foster a big army of innovative scientists and technologists for our state.

It is evident that we have suffered a great loss since we ignored the significance of the institutions of higher learning as a front army of scientific research. It is time for us to resolve the existing question on policy and cognition.

2. Emphasis should be placed not only on the study of natural science, but also on technological research which plays a decisive role in strengthening our state.

Natural science includes mathematics, physics, chemistry, astronomy, geography, and biology. I describe technological science as including the fields of agronomy, medicine and various fields of engineering such as hydraulic engineering, civil engineering, mining, metallurgy, mechanical engineering, electrical engineering, chemical engineering, and the new and still developing fields of automatic control engineering, biological engineering, management and systems engineering. Natural science is the theoretical basis for technological science. Developments in technological science give rise to further developments in natural science. Although they are closely related, one cannot be replaced by the other.

The study of natural science is vital to a country. First, it can add much to the treasure house of human knowledge. Remarkable results in the study of natural science always contributes a great deal to the scientific development of mankind. Second, it can promote the development of our technological science. The study of technological science has a direct bearing on the agricultural prosperity and public health of a state. The study of technological engineering even has a direct bearing on the national economy and defense. It

can be said that the study of natural science is aimed at serving mankind as a whole, whereas the study of technological science is aimed directly at helping and developing our agriculture, public health, economic construction and national defense. In general our state is poor and backward, with very limited resources and manpower for scientific research. The great policy problem is to decide whether we should spend most of our resources and manpower studying natural science or place our emphasis on the study of technological science so as to strengthen our country and to raise the standard of living of our people.

The study of technological science has long been neglected and it only plays a subsidiary role. The Chinese Academy of Sciences, with its focus on the study of natural science, was established in the fifties. The Chinese Academy of Social Sciences, with its focus on the study of humanities, was established in the late seventies. However, the establishment of an academy of technological sciences has never been considered.

Eighty percent of the members of the Academic Affairs Committee of the Chinese Academy of Sciences, which is the policymaking body for our science and technology, are natural scientists. Only a few engineers and technologists, who are many times greater in number than the natural scientists, have been nominated as members of the technological engineering panel.

The scientists seen in the press during recent years are mainly natural scientists such as mathematicians, biologists, etc. Therefore, those academically outstanding youngsters take natural science, particularly mathematics and theoretical physics, as their objective. It is very difficult for departments such as agriculture, medicine and engineering to enroll outstanding youngsters.

During his visit to China 2 years ago, Professor Chen Xingshen, a world famous American-born Chinese mathematician, was deeply concerned over the situation. He maintained that a country would be in danger if all of its outstanding youngsters apply to enroll in mathematics and physics departments. Professor Xie Xide, vice president of Fudan University and a famous physicist, also encouraged our most outstanding youngsters to study agriculture, medicine and engineering to fulfill our four modernizations. Professor Chen and Comrade Xie clearly knew the significance of natural science and its limitations in developing national economy and defense. Hoping to speed up our four modernizations, they gave us their sincere advice.

We should, of course, continue research in the natural sciences. However, as we are deficient in manpower and material resources, emphasis should be placed on various technological studies which are closely related to the development of our national economy and defense.

I suggest the establishment of an academy of science and engineering as a leading body to lay down plans for the study of technological science, and to give and examine assignments. Only a streamlined steering team and an administrative department are to be established. The setting up of too many research units is unnecessary. Under the direction of the academy of science and

engineering, experts and leading cadres will be called together to work out a priority list for the studies of technological science which meet the needs of our economic development and the construction of our national defense. The academy will sign contracts with the existing institutions of higher learning, research institutes and enterprise units which will be provided with funds and are required to complete their research as scheduled. Bringing the wisdom and enthusiasm of our scientists and technologists into full play by means of appropriated task funds is an effective way to speed up our economic development within a shorter period of time.

3. Emphasis should not only be placed on producing sophisticated goods, new goods and the research on technological innovation, but also on the research work of improving the sophistication and reliability of various goods.

Directed by the principle of self-reliance, our scientists and technologists have done a lot and contributed much to the setting up of our industrial system and to the improvement of our highly sophisticated technology.

However, our technological work is confronted with the problem that both the quality and quantity of many of our products are, to various extents, poor and substandard. They are unreliable, nondurable, energy-consuming and ineffective. The cost of production is high and the supply of components inadequate. The failure of our products other than our light industry, handicraft and textile industry, to meet our own competitors' standards hampers the development of our economy.

For instance, our iron and steel industry, having an annual output of more than 30 million tons, has a large stock of goods, but because of their poor variety and quality, we have to import several million tons of steel materials annually. Our mechanical industry is large, foreign capitalists marvel at the size of many of our mechanical plants. However, many of our products are backward. We have a large lathe industry which started studying computerized mechanical tools in the late fifties, nearly the same time as Japan. Today most of the foreign mechanical tools are computerized and automatic, whereas ours are mainly manual. Our internal combustion engine industry has an annual output of 60 million horsepower. Our auto and tractor industries are quite large. But our internal combustion engines, automobiles, and tractors have failed to solve the longstanding problems of oil, water, and gas leaks, high oil consumption, air pollution, and short service life. M290 20-hp diesel engines, manufactured by the Hubei Diesel Engine Factory, were sold to Hong Kong merchants at $1,200 each. The engines were dissembled and reassembled; oil pumps and oil tubes were replaced by those of a famous brand. The service life of the engines was largely extended and they were sold at a high price. This clearly shows that though some of our goods have been mass-produced for many years, the key technology of improving the quality and quantity and of extending the service life has not yet been acquired.

The reason why the quality and quantity of many of our goods are poor is that our scientific research work has been focused on the study of the creation of new products, new technology and new materials. The study will come to an end once the products, technology and materials are appraised. The study of new

products is often focused on the study of the products as a whole, without any indepth study on the system, the components or the combination of components which make up the products. As a result, the study on the products as a whole is established on the basis of unknown elements. The products will go into operation once they are appraised. There is insufficient systematic observation, study and resolution on the problems arising from the utilization of such products.

Another reason why we cannot improve the quality and quantity of our products is that we seldom carry out research work on the related materials, technology, and the standard pieces such as the solid pieces and the sealed pieces. Last year when I visited West Germany, I was much impressed that even a highly industrialized country like West Germany still carries out many indepth studies on metal materials, nonmetal materials, high temperature ceramic materials, machine components, screws and welding seams. I think that the West Germans have created the conditions for improving the quality and quantity of their products. We should follow their example.

4. During the course of scientific research, we should pay much attention to theoretical writing. However, we should attach more importance to arduous experimental work.

All along our intellectuals have paid close attention to theoretical knowledge while ignoring the practice of production. In the past few years, they have tended to be in favor of writing theoretical papers instead of doing arduous experimental work. Moreover, our present experiment facilities are relatively obsolete. The means for collecting figures and analyzing them are very backward. Experimental work requires the gathering of materials, facilities and equipment. It also requires technologists to take up difficult general work. Consequently, many technologists are inclined to make theoretical analyses while ignoring or trying to evade practical tests. Theory and practice should supplement each other. Only through practical tests can theories give full play to the development of science and technology. Without practical tests, theories often bring forth incorrect results and hamper the development of science and technology even though they sound reasonable.

Computers have developed greatly in recent years. Problems that were very difficult to work out in the past can now be easily resolved. Theoretical calculation is included in many new scientific subjects. If properly handled, the technology of calculation can provide a guideline for practice and shorten the cause of trial-and-error practices. Owing to the complication of the practical situation, the plurality of factors which affect the situation, and the fact that the drafted mathematical and physical models have failed to reflect fully the situation, the results of calculation do not often conform to actual conditions. Foreign countries often work out their design of high-performance diesels such as cylinder heads and cylinder blocks through computerization. However, serious thermal cracking still occurs during actual revolution tests. The solution to this problem often goes beyond the realm of calculation. It can only be resolved through arduous tests. Owing to our blind faith in theoretical calculation and to our ignorance of arduous

experimental work in components, systems and engines, our self-manufactured high-powered internal combustion engines easily break down after a short period of use.

Therefore, in order to contribute to our national economy and to the construction of our national defense, we should pay more attention to the implementation of arduous experimental work, and should not be inclined to study theories and to write flashy papers.

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NEED FOR OVERALL SCIENCE POLICY STRESSED

Shanghai WEN HUI BAO in Chinese 16 Apr 82 p 3

[Article by Huan Xiang [1360 6763], vice-president of the Academy of Social Sciences: "An Overall Sciences Policy Is Needed"]

[Text] During the current period when our country is carrying out its grand plan of the four modernizations, an overall science policy of planning and development is urgently needed, one that will organically integrate natural sciences, technical sciences, and social sciences. In the past, these three science fields have each isolated themselves and showed no relationship to each other. There has been a tendency to overemphasize the basic theories of natural sciences and neglecting or even downgrading social sciences and technical sciences. It is hoped that this tendency will be avoided in the future.

First, from the point of view of our national construction, our economic structure is now undergoing a change. To speed up this changing process, it is necessary to actively develop science and technology. However, the development of natural sciences and technical sciences cannot be separated from the social conditions. The development of natural sciences and technical sciences will inevitably bring with it new social issues, such as employment, education, investment direction, and foreign economic cooperation. These issues will require joint study and solution by the social scientists and the science and technical workers. Also, the major overall construction projects which affect funding resources, energy resources, ecological conditions, industrial and agricultural relationships, population distribution, transportation and communications, and military considerations must be studied on a unified and total scientific, technical, economic, and social basis to avoid long-term disasters caused by neglect in considering certain areas. These will require close cooperation between natural science, engineering and technical, and social scientists.

Second, from the point of view of the direction in the development of modern sciences, the division within the natural sciences, social sciences, and technical sciences is becoming a finer and finer line. On the other hand, through the process of mutual permeation, some new sciences have emerged on the fringe, related not only to natural sciences and technical sciences but also to social sciences. These include environmental science, ecological

economics, technological economics, archaeology and sociology, artificial intelligence, and social engineering, etc. It would be difficult to categorize them purely as natural science, social science, or technical science. These multi-discipline, multi-area science systems are increasing. This will be the principal direction of future science development.

Currently, the world's major industrially developed countries have begun to closely relate their policies for natural sciences, technical sciences, and economic and social development and consider them on a unified basis in establishing a unified policy. The primary purposes are to improve the economic benefits of investment and strengthen their competitiveness on the international markets. We are a socialist state. Our goals in establishing a unified policy for the three areas of sciences should be: to establish the most advanced, most rational, and most effective socialist economy and society; to satisfy the requirements of a planned and proportionate high rate of development; and to strengthen competitiveness on the international markets.

Our country has not had an organization for the establishment of unified policies for the three areas of sciences. I believe that now is the time to consider this question. Such an organization should consider the following questions:

1. Study the relationship between the three major science areas and our construction for socialist modernization and the relationships between the three areas themselves so that their development will be consistent with national construction;

2. In the area of the magnitude of our scientific enterprise development, study what the proper proportion should be for the development of social sciences, natural sciences, and technical sciences and gradually change the tendency of emphasizing science and engineering and making light of the liberal arts, in order to push forward faster with a balanced unified development and personnel cultivation for all three areas of science.

3. Push for both division of work and cooperation between the research forces in the three major science areas so that a rational arrangement exists in the country and the research strengths in the various areas may be demonstrated to their advantage.

I hope to see early action in this area.

5974
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REFORM OF SCIENTIFIC RESEARCH SYSTEM DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 2, Apr 1982, pp 71-75

[Article by Yu Desheng [0060 1779 0524] of the Policy Research Laboratory of the Chinese Academy of Sciences: "Several Opinions Concerning Reformation of the Scientific Research System"]

[Text] The current scientific research system in our nation is becoming less and less suitable to the needs of our nation's buildup. This has been observed by all. It requires reform, but where should we start?

The Expression and Reality of Reforming the Scientific Research System

The economic circles have been very successful in reforms marked by expanding their autonomy. Therefore, many comrades in the scientific circles also want to follow suit, and they have called the reform of the scientific research system an "expansion of autonomy." Using the reforms of the economic system as reference to push self-reformation forward is undoubtedly beneficial. But economic activity which is closely linked to the market and which is bound by the laws of prices to a definite degree is after all very different from scientific research (especially basic research), which is inspired more by nature and which explores nature's laws. In reforming the scientific research system, expanding autonomy is also an important aspect, but it cannot become the only aspect and symbol of this reform. This is because certain problems that are deep-rooted and that must be reformed, such as the coordination of subjects, mobility of personnel, socialization of scientific endeavors, often cannot be solved by "autonomy." Therefore, seeking truth from facts, proposing problems like shooting arrows, labeling the reform of the presently unsuitable organizational structures as a reform of the scientific research system may be able to reflect the nature of things more, and this will help guide the efforts towards a correct direction.

Lessons and Methods

There has not been a lack of reforms over the past 30 years, but the lessons and experience vary. How to carry out the reform so that reformation of the system can realize the expected goals? It seems that the following points must be grasped:

1. Academic exploration must be administratively decided. Although reform is urgent, haste makes waste and we must be careful. Before reformation, it is best to discuss it fully. For many years, everyone has extensively explored the reformation of the scientific research system. Certain units have also presented some ideas and carried out some trials. Enthusiasts all have their own ideas on which should be developed, which should be reformed, which should be quickly carried out and which should be delayed. In addition, the scientific research system of foreign nations has been changed many times, and there is historical experience as reference. Therefore, we should develop academic activity surrounding this question: We should survey and study the domestic and foreign situation, summarize historical experience and lessons, compare different ideas and models, and discuss and prove them. On this basis, it is not difficult to draw up several plans for selection and trial implementation. Spontaneous decisions that have not been proven will frequently lead to results contrary to expected goals.

2. There must be experiments. Things that have been proven academically may not necessarily be able to stand up to practical tests, like newly designed products which may very possibly show defects in practical use. Therefore, prior to an overall reform, the plans which are presented for selection must be tested separately, and then they must be analyzed and combined. Their advantages and shortcomings must be compared and even retested. A popular saying states that "a tailor measures seven times but cuts only once." This is the reason.

3. We must allow for many ways. Besides comparing many plans during the experimental stage, official reform must also allow different methods of doing things on the basis of unified general principles. This is not only because each research unit is different from the other in the type of research, it is also because there are different ideas in management methods. We must allow them to compete and to show their advantages and shortcomings in competition, and open up our own road. History has proven that regardless of how large or small the task, if everything is done in the same way, frequently many chances for survival will be killed.

Socialization of Scientific Endeavors

Scientific research must realize socialization to the maximum. Any kind of division of labor means cooperation. Cooperation, even the simplest form of cooperation, will bring about gain unimaginable in singular effort. It can be said with determination that a nation's scientific research work will become a business that is rich in achievements and that is highly efficient only when it is established on the foundation of a high degree of social division of labor. Conversely, if it is managed like a small farm enterprise, and if it scarcely relies on social forces, it will not be possible to have a high efficiency and produce many achievements.

Under present conditions in our nation, the main aspects of socialization of scientific research work should at least include the following:

1. Coordination and cooperation between topics. In foreign nations, some people advocate that certain subjects can be intentionally and repeatedly included in different research organizations to increase the probability of success, hasten its progress and expand its influence. But in our nation, scientific research funds and manpower are limited, and for general subjects this should not be commonly done. Only a few key subjects can be considered for such arrangement and they require unified arrangement. Viewing the current situation in our nation, there are situations in which research personnel are not allowed to select their own subjects but rather, subjects are forced upon them. There are also situations in which subjects are selected at will and subjects are established at will without any coordination. Foreign colleagues often express bewilderment at the massive number of subjects proposed together. This kind of "expansion of autonomy" is not good. In the future, we must allow research personnel to have the freedom to select the subjects (especially basic research) on the one hand, and on the other hand, we must strengthen organization and coordination. This is exactly a manifestation of the policy of "developing the superiority, encouraging competition, promoting unity" in scientific research.

In foreign nations, subjects are registered by an information center (input into the computer), and progress of each phase is reported so that researchers can research and make enquiries. This method is worth learning. Only by exchanging information can we avoid redundancy and blindly establishing subjects, and this also facilitates coordination and cooperation. If our nation can order all research units to obligatorily report the subjects to a certain center, and the latter can report to each scientific research unit, then this method can be accepted. The national administrative agencies that oversee scientific research have the power and the duty to coordinate major subjects (such as important subjects and subjects requiring large investment). Subjects that are not key subjects require only that they be reported, and it is not necessary to strictly coordinate them.

2. Experimental equipment, large instruments and books and information should be shared. Regardless of how large or how expensive the instruments and equipment are in our nation, they are all assigned to the research institutes (even laboratories) for their specific use. As a result, state investment is huge, the rate of utilization of the equipment is low, and frequently the equipment becomes outdated before there is time for it to serve its functions fully. In the West, laboratories have been commonly opened to the society for a long time. Recently, the government of the Soviet Union has also decided to ask each university to establish public laboratories open to the public. These efforts are effective ways to establish high level, high efficient and low cost modern laboratories which have a high rate of utilization. At the same time, they are also an effective measure to develop scientific research. In the future, we should establish some different types of public laboratory facilities (including presently existing ones which can be converted to public use) in some cities where scientific research units are concentrated according to plans. The large equipment that is worth more than a certain value and that has been obtained by the research units themselves should be readjusted or be regarded as being loaned from the state, and they should pay rent, or the equipment can belong to the research units but they must deduct depreciation

from the total funds for scientific research annually. Accounting for research institutes can consider the establishment of accounting for scientific research projects and accounting for single project equipment while public laboratories can sign contracts with research units to charge hourly fees.

Laboratories can be shared and so can books and information facilities or data banks. Our nation's research units are often right next door to each other, but each builds its own library and information systems. This is wasteful. Foreign nations have had school libraries and institute libraries for a long time. Many institutes of the Shanghai branch of the Chinese Academy of Sciences do not have their own library, but utilize the institute's library. The results are good. Facts prove that an institute-wide library is a good method of low cost and highly efficient service.

3. Socialization of logistical support and life services. The time spent by our nation's scientific research personnel in logistics and living problems (such as instruments, material processing conditions, purchasing coal, purchasing groceries) varies according to the differences in local conditions. The time spent for such activities in small towns even surpasses the time for scientific research, and for the scientific research backbone personnel, the time spent for such activities is much more. People have long noticed: Among the several people similarly talented and hard working, frequently those who remain abroad have outstanding achievements while those who have long returned have made little achievements. Besides the conditions for experimentation and information exchange, logistical support for research is poor, and spending too much effort on making a living is frequently the main reason. If we can organize a scientific research instruments service company and a living service company, we can save a lot of precious time for scientific research personnel. This is the same as increasing the number of hard to find scientific research personnel. To provide living services for scientific research personnel, the fees should be low and there should even be subsidies. This is because the income of most scientific research personnel is very low. Otherwise, we could not afford to hire them. Practice will prove: It may seem that what we have grasped is an insignificant thing, but it will serve a function that is far from expected. This is like Lenin, who inquired about the food fed to the dog used in the Pavlovian experiments and about the conditions in the Zelinsiji Laboratory. It far surpassed the superficial significance.

Of course, the question of socialization not only involves the above aspects. The socialization of scientific endeavors presupposes a high degree of specialization. It opposes natural economic methods. Its fundamental advantage is that it can centralize within a specialized agency the work of the same nature but managed separately in a scattered manner by many units. Therefore, it can produce a higher efficiency, a higher technical standard and a better quality of service at a lower cost. Therefore, all endeavors which can be socialized (this also means specialization) should be socialized.

Scientific Exchange

Science is a business of manufacturing knowledge, while knowledge is expressed by information. Therefore, we can say that science exists in exchange. With-

out exchange, even existing knowledge will be dead and new knowledge will not be produced. Therefore, exchange is the spring of life of science.

There are many forms of exchange. Publication of theses and reports (including conferences) is a fundamental method. Besides this, the exchange of personnel frequently has a special function that cannot be replaced by other forms. Many known scholars, especially Nobel laureates, have pointed out that when they worked under famous scholars, it was not how much knowledge that was taught but the ability to take charge of the direction and to capture major problems learned from them, the stubborn self-confidence and self control and the good style of scientific research... This cannot be taught through reading documents and conducting scientific discussions. From the 1940's to the 1950's, America's science and technology developed prosperously because they profited from the large number of European scientists who came to the United States and because American scientists before the war learned and worked at most of the famous European laboratories. Because of this, today's European and American scientific circles all oppose "self propagation" in science but advocate "hybridization," and they have formed a system: Graduates do not stay at their own school to work. Schools or research agencies encourage their own people to go elsewhere to work and they take in people from other units. The Japanese originally practiced lifetime service at one unit. The greatest shortcoming of this system of a rich Oriental flavor is now felt to be that ideas easily become rigid, and change is sought.

The system practiced for many years in our nation is basically that of the scientific research personnel staying at one unit "from the beginning to the end." This is a reflection of the conscience of feudal agricultural economy in scientific endeavors and it very easily causes thoughts to become rigid. The new superseding the old in personnel is not active, and there is a lack of vitality. The main problem at present is to relax the confinement of personnel, stimulate exchange, and change the policy of "locking our own doors," Exchange of personnel involves simply this: For the individual researcher, he can go to other units to work for a short period or for a long period. For the research institute, it should have the authority to select and hire or dismiss its own workers. This requires revising the present personnel system and implementation of a labor contract system: According to contract stipulations, both sides should carry out their duties. As soon as the contract is fulfilled, both sides can free themselves from further obligations.

Expanding Autonomy

The shortcomings of overcentralization and overly tight centralized control have seriously affected the healthy development of scientific endeavors.

First, in the authority over personnel, the responsible persons of all institutes, and especially the research laboratories, do not have the authority to select their own team. Frequently, the decision to hire or not to hire a person and to match the "bound couples" is in the hands of those who are not in charge of business. Scientific research work is different from productive labor. The requirement for coordinating and supplementing thoughts, opinions, methods, understanding and cooperation in work is high. These special

qualities cannot be solved by the personnel lists and cadres' files. This problem can only be solved well if the authority to select personnel is handed over to the organizers of scientific research work. Therefore, a better method at present is to implement the policy of letting the agencies of higher authority control the number of personnel, the funds and personnel policy while the hiring and dismissal of personnel are handed over to the research institutes. Within the institutes, the "responsibility cabinet system" can be implemented, i.e., the leadership of the institute can organize the research laboratory and group personnel according to the research task and assign persons in charge. The person in charge can select his own helpers to be approved by the institute. Of course this means that the source of manpower must be guaranteed and that unneeded personnel will have an appropriate place to go, otherwise, the talk of personnel exchange and the new superseding the old in personnel will be empty talk.

The second is financial authority: At present, finances are controlled too tightly, and this is not favorable to mobilizing the enthusiasm of the lower echelons. Of course we should strive towards reducing state expenditure, but this alone is not enough. The establishment of a financial system should benefit the realization of the main goal of scientific research agencies: the completion of more scientific research work of higher standards. For this, it seems that there are several principles which should be implemented in the reforms:

1. Investment at different levels for scientific research projects should be implemented so that the key issues of the overall situation can be guaranteed and the enthusiasm of the basic levels can be fully developed. The key projects of the state and of a certain major sector must be reviewed and budgeted by higher authorities. Their budgets must be determined and funds should be appropriated in different years (some nations have already changed this to loans and final accounting, and this can also serve as a reference). In addition, the institutes can also set up a scientific research fund to pay for scientific research projects approved by the first rank authority of the institutes. The scientific research funds of the institutes can be determined by the number of people and past work achievements, but the total amount of the scientific research fund of an institute must be linked to the achievement of the work accomplished, i.e., the more work accomplished and the better the work accomplished, the more directly appropriated funds a project can obtain. Therefore, there will be a greater possibility to develop work that one believes is significant. This creates a snowball effect: The units that produce more outstanding work will have more possibility to independently develop some hopeful work. Greater possibilities will be obtained because of such work,..., and the cycle continues.

2. Workers' salaries (not limited to wages) must be linked to the quality and the quantity of the work accomplished by the institutes. For this, we must establish a related system, establish corresponding organizations and systematically evaluate the work of each link and every person. We can refer to the experience of the industrial departments without violating the national wage system to provide internal wages and link the variable part of personal income, such as rewards, percentages of various cash income and non-monetary benefits (such as housing, vacations) to scientific contributions.

3. Separate management and separate economic accounting should be implemented. Financial management of basic research and applied research should be differentiated. Scientific research funds should be classified according to investment, the amount of appropriation and separate balances to facilitate inspection of the results and to calculate costs. Within legal limits, commissioning units that commission certain research projects that have a strong nature for application (party A, also including higher authorities) should sign contracts with scientific research units (party B) to establish the financial responsibilities of both parties, and appropriation of funds by party A (commissioning party) according to contract can also be considered. Funds left over are not returned (party B can keep the unused portion) and shortage of funds are not subsidized (party B is responsible for extra expenses). The equipment owned by each scientific research unit, specialized experimental units and computing units should be made available to the public, and services provided should be paid for. A portion of the additional income from high quality services and improved rate of utilization of the equipment should be under the discretion of the unit itself for use in expanding business or for collective welfare. The rest can be used as monetary rewards to workers.

Distribution of Scientific Research Agencies

In the question concerning the distribution of scientific research agencies, such a viewpoint was once popular. It seemed that the more scattered they were the better, and the more remote their site the better. Of course, we cannot concentrate all of the nation's scientific research agencies in one or two cities. And besides, the nature of some units determines their locality of work (such as oceanographic studies, the study of tropical plants, the study of salt lakes). But generally speaking, if there are no special limitations in geographical conditions, research agencies should be distributed according to the principle of being scattered broadly and concentrated in small numbers. This means, nation-wide, there should be several scientific research centers (cities), while within each locality they should not be overly scattered and should be concentrated as much as possible.

When establishing research agencies, we should follow regional centralization or the method of building cities of scientific enterprises. These methods have many advantages which cannot be neglected.

First, large laboratory facilities, computer stations and libraries can be shared, and this is favorable to socialization of scientific research.

Second, this is favorable to socialization of living services, such as building various service enterprises (child care centers, mess halls, family life services). If the distribution is overly scattered, these types of businesses will be very difficult to establish, and problems in living will necessarily take away the energy of research personnel.

Third, this benefits academic exchange and cooperation. Having research personnel who can live next door to each other, or who can converse after meals or visit each other after work will help exchange views and provide mutual encouragement. Many ideas and views are formed in such conversation. Because

the institutes are close to each other, interdisciplinary cooperation and academic exchange can be more easily organized.

Fourth, this benefits the development of talent. The regions where scientific research agencies are concentrated easily produce talent among workers or their dependents because of the research atmosphere and the encouragement of academic thought.

Because concentration has so many advantages, many nations have established science cities. For example, Japan's Tsuha Science Town is reported to have more than 20 scientific research units and higher educational institutions. The New Siberian Science Town in the Soviet Union now has 56 research institutes, and it has become one of the most important scientific research bases in the Soviet Union. According to Soviet reports, the Siberian Branch based in the New Siberian Science Town is the branch with the highest efficiency and the greatest achievements among all branches of the Soviet Science Academy.

Division of Authority and the Establishment of a Supervisory and Regulatory System

Many years of experience have proven that overcentralization of authority is dangerous to political authority and the economy, and it is unsuitable to scientific endeavors.

Last May, the fourth meeting of members of the Academic Department of the Chinese Academy of Sciences passed the "trial charter of the Chinese Academy of Sciences." It clearly separated the authority of the power holding agencies (the council of the academic department and the presidium) and the executive agencies (director of the academy and its leading agencies). It has provided a model for the direction of reform of the scientific research system. It will serve greatly in pushing forward future reforms of the system.

No system can be perfect and without shortcomings. They key is to establish a system that can prevent or correct at any time all possible flaws--a supervisory system. The more authority the basic levels have, the more important this problem becomes. When Lenin was on his death bed, one of the major problems that he never forgot was the establishment of a strong and powerful supervisory agency. The unfortunate history of the Soviet Union, especially the acts of stepping over the legal system and destroying science from the 1930's to 1940's proved that Lenin's worries were farsighted. Therefore, it can be imagined that the system of scientific research agencies in the future can generally be: separately established independent executive agencies, supervisory agencies and academic evaluation agencies under the power holding agencies within the scientific research agencies.

The executive agencies are the administrative agencies in scientific research. They are responsible for carrying out the laws of the state, policies and decisions of the power organs of the unit itself, and they exercise daily management in organizing and coordinating scientific research work. Supervisory agencies are responsible for supervising the executive agencies at each level in implementing applicable state laws, policies and decisions of

the power organs of the unit itself. They can suggest ways to handle personnel who have made mistakes, and guarantee the proper rights and benefits of the workers. We must emphasize: only if the supervisory agencies are independent of the executive agencies can they avoid becoming a satellite and can they effectively perform their own duties. Therefore, in the organizational system, they are directly subordinate to the power organ, and they should form their own system under the leadership of higher supervisory agencies. A strong and forceful supervisory system is like the immune system of the human body. It is a forceful guarantee of the health of a system. Academic evaluation organizations should be advisory agencies with an independent position. They can make independent judgement and evaluation of related academic questions. Of course, the power organ or the administration may not completely agree or accept the evaluation, but discussion and judgement by the academic agencies free from interference should be the necessary prerequisite procedures and bases for the latter two types of agencies to take action related to academic questions (such as the drawing up of plans, the determination of major projects, signing of contracts, evaluation of achievements, delegating authority). The division of power is very complex and it should be carefully discussed and studied, and corresponding rules should be stipulated. Under such a structure where authority is divided while centralization is still guaranteed, generally speaking, major unexpected mistakes can be prevented. When deviation occurs, it can be easily corrected.

9296
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BUILDING UP QUALIFIED TECHNICAL MANAGEMENT PERSONNEL URGED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 23-26

[Article by Dai Zhenhai [2071 6966 3189] and Wang Miaoyang [3769 8693 3152] of Fudan University, Shanghai: "Accelerate the Build-up of Technical Management Ranks Through Intellectual Investment"]

[Text] The management of modern science and technology is in itself a science. It is the management of science and technology according to the laws of development, and its characteristics, and the most effective use of manpower, money and material. It is an important guarantee for rapid development in science and technology and for the improvement of the productive force. In a certain sense modern technology and scientific management are the two driving forces behind the progress of a modern society. International economic competition after all is competition in the speed of development of technology and the quality of management. Therefore, when we indulge in the modernization economic construction, we not only should pay great attention to the role of technology but also have a thorough understanding of the great significance of strengthening technical management and the training of management personnel. The construction of a specialized, technical management team is an urgent task in the promotion of science and technology development and the improvement of the party's leadership over technology.

1. A common experience of successful developed nations is the emphasis of building up a specialized, technical management rank. The successes of rapid economic development of many nations after World War II are all due to emphasizing systematic and purposeful training of management personnel.

The history of technology and economic development of the United States is a process of continuous improvement of intellectual investment on the management rank. After the war, the technological and economic development of America, a nation established less than 200 years ago, has far exceeded that of Europe with its long history. In analyzing the causes for their lagging behind, the Europeans believe that the difference is in management rather than in technology. Over a half century, the United States has formed a huge network of management colleges and trained a large number of management specialists. As early as 1881 the University of Pennsylvania first established its business college and trained largely junior level management personnel. American

President Hoover advocated in 1920 that: "America's great need in manpower in the future will be political talents with leadership ability in the area of economics." At the urge of this alummus, Stanford University established its institute of business management in 1921 and in the 50 years thereafter trained about 10,000 senior management talents. Many other universities have also established colleges devoted to the training of management personnel and the most famous one is at Harvard University. One-fifth of the high level management and leadership people in 500 largest American companies are graduates of Harvard University. According to 1977 statistics, out of 284,200 senior technical staff with doctoral degrees in America, there are 66,500 management doctorates, or 23.4 percent of all Ph.D.'s. Almost one in every four Ph.D.'s are in management, this shows the high demand on the specialization of management people. According to a report by the American Education Statistics Center, today there are 1,156 universities in America that have business colleges and the total number of undergraduate students is 900,000 or, 15 percent of the total number of university students. Technical manager of the Manhattan project in the 1940's, 38-year-old physicist Oppenheimer concluded that "scientific organization and management allows science and technology to develop its full force." In the 1970's, Apollo project leader Dr Weber also said: "There is not one technology that we use that other people don't have, our technique is scientific organization and management." These examples show that, in the creation of these epoch-making technological achievements, "scientific organization and management" played a major role.

After Russia began its large-scale economic construction, they also placed relatively heavy emphasis on the training of technical and technical management personnel. By the early 1950's, several million cadres had received higher and vocational education. They had a slogan: "learn from Harvard." In 1960's, Soviet Union devoted considerable manpower and money toward scientific research, research investment expenditure reached 2-3 percent of their gross national product and the number of staff in research departments jumped to fifth place, next only to industry, agriculture, construction and transportation. Under those circumstances, the development of modern science and technology was required to shift from quantitative increase (increase in manpower, finance and material inputs) to qualitative improvement (largely improvements of organization management and senior research training). From then on the Soviet Union stressed the improvement of technical management and quality of technical management personnel. Today there are more than 1 million people studying management in 50 universities in the Soviet Union. Management cadres at all levels are required to study at management universities and their regulation also requires retraining in a few years.

2. Upgrading the management cadre ranks is an important measure in speeding up technological development during the readjustment period and is an urgent task to be solved now.

For now and several years hereafter, the Chinese economy faces a period of readjustment. In this period the economic development will shift from an external expansion to rely on internal improvement. Science will play an increasing role in economic development and the application of research

results will more and more affect the rate of economic and social development. Therefore, the primary question we face now is how to use effectively the resources devoted to science activities. This requires a corresponding system to improve the efficiency and quality of science management and activity. In other words, the emphasis should be on the qualitative improvement of technical management and not relying on the quantity of manpower, money and material devoted to science. It was reported that in Norway during the 55-year period of 1900-55, production increased 0.12 percent for every 1 percent increase in fixed capital, production increased 0.76 percent for every 1 percent increase in labor force but production increased 1.8 percent for every 1 percent increase in trained management staff. This shows how important management improvement is. The key to management improvement lies in the quality improvement of the management rank, the rank must be specialized if the management is to be scientific. Strengthening the specialized technical management rank and improving the quality of scientific management are indeed urgent tasks in the readjustment period.

Judging from the actual situation in China today, one might say that technical management is even more underdeveloped than technology and the shortage of technical management talent is even more serious than the shortage of scientific and technological talent. The conflict between the modernization demand of science and technology and today's underdeveloped technical management is becoming increasingly acute. We now have the following prominent problems regarding the construction of a management cadre rank:

The first problem is the lack of specialized knowledge and vocational training of the present management cadres. A survey was made last year in 80 research institutes in a certain city, among 303 institute level leadership cadres there were only 20.6 percent technical and management staff who are knowledgable about the specialty, as many as 66.3 percent of them have a culture level below the intermediate level. In a survey last year made at 2 bureaus in a certain city, less than 10 percent of 266 cadres above the section chief level had management training or college level education. Even in units with relatively high culture level, management cadres also lack management training. At one university in Shanghai 90 percent of 146 cadres at the section chief and commissioner level had college level education but no management training. Two-thirds of them are not familiar with teaching management and technical management, three-fourths of them are unfamiliar with the history of natural science and five-sixths of them do not understand computer technology and scienology.

The second problem is caused by the long-term interference by the leftist thought and "laymen directing the experts." Consequently, there has been no specific requirement and regulation regarding professional and educational background of technical management cadres and the training of technical management specialist was looked down upon. In the early days after the founding of the People's Republic there were still some management colleges and departments but they were later gradually phased out. A great majority of the management graduates in the 1950's from some universities were assigned to jobs unrelated to their specialty, some systems trained several thousand management graduates but had no positions to assign them to and almost all of them

have switched professions. In other countries, due to the management need in the 1960's, management specialty had the largest number of students and the fastest growth. That period was therefore known to some as the "age of operation and management." But we have paid almost no attention to the training and use of management graduates. Because of the lack of specific requirements and regulations on the professional and educational background of management cadre, some technical departments increased nontechnical administrative staff in great numbers and such incidents continued to occur even during the past 2 years. Technical management cadres should not only understand the basic knowledge of their technical specialty and economics, but should also possess fundamental knowledge of technical management, understand the special features and general rules of science and technology, be familiar with the party's technology policy and have a certain ability for organization. We cannot equate party and political cadre to technical management cadre and we cannot equate technical specialist to experts on technical management. For a long time we have not been treating technical management as a science and have paid little attention to the specialization of a technical cadre personnel, today most technical management cadres--including some old cadres and some new cadres with college educations and technical titles but new in the profession of technical management--to some degree are laymentin technical management and they all face the problem of learning the knowledge of technical management and knowledge renewal.

The third problem is that the policy of intellectuals in the technical management rank was not put on solid basis. Unification of the professional title in management was slow, the ranks were unstable and for a long time promotion was slow and salary was among the lowest of intellectuals with equal qualifications. If this situation is not corrected quickly we cannot expect them to play a full role and possess high efficiency in management even with relatively good equipment and an advanced facility.

3. To a large extent the quality of management depends on the quality of management cadres. In order to rectify the underdeveloped situation of technical management in China, the pressing obligations, besides continuing to improve ideological awareness and overcoming the influence of the erroneous leftist thought, are to take effective measures in intellectual investment as quickly as possible, establish the necessary policies and put them on a solid basis and make a great effort to establish a specialized rank of technical management. To this end, we have the following recommendations:

(1) Based on the requirements of the specialty, personnel departments should institute specialty requirements and management methods of technical management cadres at various levels and of various types (overall management and job management). In the future, the addition of management cadres should be made after a training based on the requirements of the specialty. Special attention should be given to those cadres who are solidly behind the party line of the 3d Plenum of the 11th Party Central Committee, enthusiastic about the enterprise of science and technology, familiar with intellectuals and of high integrity to do the job of managing technical management cadres.

(2) We must actively and steadily improve, strengthen and adjust the current management rank and rectify the current personnel structure and knowledge structure.

Of the many management cadres currently available, most of them have relatively rich practical experiences but lack the knowledge of modern science culture and scientific management. Forceful measures should be taken to train them in shifts. According to different cases, we should actively help them learn the technical profession and the fundamental knowledge of economics and management science, then select and train a group of cadres who are in their prime years and who basically qualify as to professional requirements and make them the backbone of technical management force at different levels.

In the meantime, we should attract a group of talented management experts (or specialists) to strengthen various leadership posts and important management departments. The tendency to neglect management knowledge and ability should be avoided in the selection.

In addition, qualified institutes of higher learning should actively assume the duty of training management talents, organize business management colleges and departments and cultivate a new generation of management manpower and vigorously develop management science research.

Through efforts in the areas discussed above, we should strive to nurture and cultivate a large number of management specialists in the next several years who are familiar with the Chinese situation and know the management profession.

(3) In an overall plan, we should thoroughly conduct training of technical management cadres currently on the job. A national technical management cadres' training program should be formulated while keeping in mind the requirements of enterprise development and building up a professional management rank. The target for training at various levels and the number to be trained, the progress and standards should be determined according to the management jurisdiction and type of business of the cadres. Division of work and responsibilities should be arranged in a coordinated fashion and the aim should be for one round of training for all the technical management cadres within 3 to 5 years.

The training of technical management cadre has received wide attention by various ministry committees and provincial and municipal science committees. Most provinces and municipalities have already conducted 1 or 2 semesters of class study and obtained some results. The outstanding problem now is that most provinces and municipalities do not have fixed training bases and lack professional teaching staff and material suitable for our situation. There is also a shortage of special organizations and resources to study how to conduct this training education. If this situation persists, it will affect the result of cadre training. We therefore recommend the establishment of national and local technical management cadre training bases. Independent colleges for technical management cadre improvement may be instituted or training points may be set up with collaboration between the science committee system and relevant institutes for higher learning to overcome the current make-shift situation in cadre training--just before training is to be conducted, a place is borrowed, a teacher is found, notes are mimeographed and a sign is put up. Cadre training has certain special requirements and should

satisfy the needs of the trainees, they not only need to study basic knowledge and theory but also to investigate real problems and learn how to apply the training. The training standard should be rigorous in order to maintain quality.

In order to speed up training base installation and the management profession, a teacher pool consisting of college teachers, management cadres and research staff should be formed, the writing of teaching material and basic reading material consistent with the Chinese situation is also a pressing need. National training centers for professional teachers of technical management should be established and these professional management teachers should be concurrently appointed to do management work or to participate in technical management consulting. Different workshops should be held and a major effort should be made to consolidate our own experience in technical management.

(4) Policy on technical management staff should be studied and gradually perfected and finalized. In the selection of superior management cadres we should adopt a policy that treats them politically favorably and economically no worse than technical staff of equal qualification. In considering the salary of the management cadres, job title, rank and seniority should be taken into account. Evaluation of technical professional titles of the management cadre should be conducted carefully and their effort to improve their own professional management ability and quality should be encouraged so that management personnel at all levels have a definitive direction for their effort, and initiative can be fully developed and high efficiency of management assured. Participating in overall management and engaging in management research are both avenues for advancement for management cadres. Special attention should be given to the training and selection of overall management talents, a method combining training and selection should be employed systematically to select candidates for overall management from professional management cadres. Direct evaluation to general management posts of professional personnel without management specialty experience should be prevented. Efficiency consists of three factors: initiative, encouragement and competition. Encouragements should be given to those with prominent achievements and contributions. A system of regular and periodic training and evaluation is also needed. In the professional evaluation of management cadres, appropriate examinations on basic knowledge should be given to new workers and the evaluation items for management cadres with academic degrees or many years of experience should largely include work results and management efficiency and whether their recommendations based on investigation research were adopted and what results they produced. Evaluation methods separated from job results and efficiency are undesirable and will not have a positive effect.

An important mission on the technological front during the readjustment is to make wise intellectual investment and to speed up the construction of a professional technical management personnel. If our various party organizations and departmental leadership attach great significance to this mission and take effective measures to organize training, build up the personnel, improve professional quality and carry out the policies, then, after some years, a qualified professional technical management team will be playing an active promotional role in the economic development and technological enterprises of China.

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CURRENT POLICY AND MAJOR MEASURES IN THE MANAGEMENT OF SCIENTIFIC AND TECHNICAL PERSONNEL

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[Article by Ai Dayan [5337 1129 3508] of the Scientific and Technical Cadres Bureau of the State Council: "Policy and Major Measures of Managing Scientific and Technical Cadres"]

[Text] According to the political line, the guiding principle and the policy of the Central Committee, we can summarize the concrete guiding principles, policies and major measures of managing scientific and technical cadres currently being implemented in nine aspects.

I. On the Basic Policy of Management of Scientific and Technical Cadres

First, we must thoroughly implement the Party's policy concerning intellectuals. The Central Committee has instructed us many times: "Our nation's broad number of scientific and technical cadres includes most of the scientific and technical cadres from the old society. After a long period of training and education by the Party and during the movement of the Three Great Revolutions, they have become a part of the working class, and they are exerting efforts and self-consciously serving socialist endeavors. They are the forces which the Party relies upon, and they are the treasures and wealth of the Party and the nation." The key points in this statement are as follows: First, we must recognize that the broad number of scientific and technical cadres of our nation includes most of the people from the old society and they have already become a part of our working class. They are the forces which the Party relies upon. Second, we must recognize that science and technology are the keys to realizing the four modernizations. These two points are the starting points of the basic policy of our efforts to manage scientific and technical cadres. If this question is still affected by leftist ideology, then the cadres will not be managed well. The Central Secretariat made the following basic evaluation of the work concerned with the present team of scientific and technical cadres: After fall of the "gang of four," especially since the 3d Plenum of the 11th Party Congress, the position of scientific and technical work has been elevated, but it has not risen to the height it should have. Up to now, many comrades throughout the Party still do not clearly understand the importance of scientific and research itself, in the popularization of scientific

and technical achievements, and in the use of scientific and technical cadres. Because the neglect of science and technology among some cadres has been formed over a long period, therefore solving these problems cannot be too hasty. To enable comrades of the whole Party to improve their understanding of scientific and technical work, we must first improve the understanding of the leading cadres at each level. The Party committee at each level must include scientific and technical work in the daily agenda of important business. It must use facts to educate everyone so that people will truly believe that science and technology have already served a great function in socialist construction. Is our nation's team of scientific and technical cadres a part of the working class or not? Why do we say that it is a part of the working class? We can explain this by analysis: Our nation's team of scientific and technical cadres consists of 5.29 million people, including four groups: The first group includes those who were trained in the liberated areas before and after the period of resisting Japan and those who were sent to the Soviet Union to study. The second group includes those remaining from old China. The third group includes those who risked their lives by returning from Western capitalist nations at the beginning of the founding of the nation. The fourth group includes those trained by ourselves over the past 32 years since founding of the nation (including students sent abroad), constituting about 90 percent. The first three groups have been trained and educated for many years by the Party and have made a lot of contributions. Students sent abroad by us mostly studied sciences and engineering and medical sciences. These people are the backbone forces at their posts. In treating such a scientific and technical team, can we still doubt that they are not our own people? In general, recognizing that scientific and technical cadres are a part of the working class and that they are the forces which the Party relies upon should be the most fundamental guiding ideology for all of us who are involved with scientific and technical cadres.

The Central Committee pointed out: science and technology are the key in building the "four modernizations." The reason underlying this question can be explained originally in theory by Marxism-Leninism and in practice and experience. But some comrades still have an insufficient understanding today. Everybody knows that according to statistics, in internationally developed nations, 50 to 67 percent of the achievements among the factors of their economic growth relied upon progress in science and technology. This means that economic development brought about by progress in science and technology constitutes about 70 percent. In many nations, some products are renovated and replaced every 5 to 10 years. For example, fifth generation computers have emerged. Only some 30 years have passed from the emergency of the first generation (1945) computer up to the present. From the advent of the electron tube, the transistor to integrated circuits and from large scale and small scale to integrated electric power, scientific and technical development has continued to renew and replace each predecessor and the generation changes. This shows how great the function of science and technology is in economic development. They can be directly converted into a productive force. They enable products to be renewed, replaced and sold, and they bring about a large scale development of the national economy. Science and technology are the foundation of our socialist development. Science and technology can be directly converted into a productive force, and productive forces are the

fundamental conditions for pushing social progress forward. Stalin said: "The fundamental economic law in a socialist society is to use methods of continual development of production on the basis of a high degree of technological development to satisfy the continually increasing material and cultural needs of the broad masses of people." His emphasis was still on the prerequisite condition of "a foundation of a high degree of technological development" to explain that science and technology are the key.

During the period of readjustment, the Central Committee has emphasized repeatedly that we must mainly rely on the efforts of existing enterprises to develop potential, to carry out renovations and improvements. This requires fully developing the enthusiasm and creativity of scientific and technical personnel.

Comrade Zhao Ziyang once said: "Development of the national economy must rely on science and technology. Science and technology must serve the national economy. Now, the problem is to practically develop the function of science and technology so that they can truly become the great forces in improving economic results and promoting economic development." These statements explain the relationship between science and technology and the development of the national economy very clearly. Science and technology should develop with the economy and society in a coordinated way, and promotion of economic development should be the foremost task. Here, I want to introduce some information regarding the United States. The information analyses six reasons why American science and technology lead the world, and these are six necessary conditions.

First, every sector of society has a relative recogrition of the important function of science and technology. The government has passed legal means and has implemented various policies and measures to protect the development of science and technology.

Second, there is sufficient scientific research funding.

Third, education is developed to train scientific and technical talent and attention is paid to developing the function of scientific and technical personnel in scientific research and production.

Fourth, the massive market capacity has opened up a broad world for application of scientific and technical inventions and achievements. This is an important factor that has stimulated the development of American science and technology.

Fifth, military science and research are not only emphasized, relatively more attention has been paid to the mutual "transfer" of military technology and civilian technology, thus American military science has been pushed to the fore of the world. At the same time, the development of American civilian science and technology has been pushed forward by a definite degree. When civilian and military science and technologies can be mutually transferred, civilian factories can be converted to military use when necessary, and military factories can be converted to civilian use during peace time.

Sixth, the United States has always paid more attention to management science, and for a long period, it has gradually formed a relatively systematic management method in scientific and technical management.

The heart of these six aspects is that they emphasize the important function of science and technology in developing the economy and national defense buildup. We can learn from this. Of course, the United States is an imperialist nation. It plunders foreign lands and exploits domestically. This is not compatible with the goals of economic buildup of socialist nations, but we can utilize the advantages of some of its successful methods.

II. Basic Requirements for Scientific and Technical Cadres

Scientific and technical cadres must support the leadership of the Communist Party, they must love their socialist motherland, they must insist on upholding the four basic principles, they must actively serve socialist construction, they must work and study hard, they must grasp advanced science and technology, they must exert efforts to climb the peaks of science and technology, and they must contribute to the realization of the four modernizations. These are the basic requirements of scientific and technical cadres, and generally speaking, they have to be both Red and expert. The first half talks about being Red, the latter half talks about being expert. The question of the relationship between being Red and expert, I believe, should be as Comrade Deng Xiaoping said: "Being expert is not the same as being Red, but being Red must be expert." Saying that being expert is being Red is not correct. Being expert does not mean being Red. Being Red is a requirement of political ideology. It means to support the leadership of the Communist Party, to love socialism, to insist on upholding the four basic principles, and to actively serve socialism. But being Red must be expert. If a cadre wants to serve the people but commands blindly in actual work, does not do things according to regulation, and acts contrary to economic laws and science, then he is not a qualified cadre. To serve the people, one must have a definite ability to build socialism and one must have some true capabilities. If a leading cadre always speaks unprofessionally, does unprofessional things, uses nonprofessionals, and always acts inconsistently with objective laws, I believe he is not a good leader. We must continue efforts to change the nonprofessional to a professional. I feel that special emphasis must be placed on upholding the four basic principles. In the final analysis, it is a question of establishing the proletariat world view and the core is to insist on party leadership. Without the leadership of the Communist Party, there will not be a socialist road. Without upholding proletariat dictatorship, there will not be socialism. The practice of the Chinese revolution proves that Marxism-Leninism and Mao Zedong Thought are our nation's guiding ideologies. Therefore, scientific and technical cadres must learn the basic principles of Marxism-Leninism well and unswayingly uphold the four basic principles.

III. Academic Guiding Principles and Policies

We must thoroughly implement the guiding principle of "let a hundred schools contend," and insist on the principle that practice is the only standard of

examining truth. We must break superstition, liberate thoughts, develop democracy, encourage free exploration, mutual respect, unity and cooperation among people of different academic schools and holding different academic viewpoints. The question of right or wrong in academic pursuits and different opinions can only be solved through free discussion and scientific practice. We cannot use administrative means to draw conclusions. We must guarantee that everyone has the right to criticize, retort and hold opinions. Even if one's academic viewpoint has been proven wrong by scientific practice, we must not accuse him by giving him a political label. This is the basic guiding principle concerning academic questions.

The task of natural science workers is to understand nature and improve nature. The so-called understanding nature is to study and explore and discover objective laws of nature. Understanding laws of nature requires a course of exploration, and there is a process of accumulation which is also a course of continued and deepening development.

In the long river of development of things, all truths in a particular stage of events and under definite conditions are relative truths and are not absolute truths. These truths are only proven to be real and accurate under a definite condition. But, further in depth study along with the development of other objective conditions makes understanding more profound and there will be new discoveries and new laws. Because the development of objective things is limitless, therefore the development of people's understanding of nature will never end, but will approach absolute truth step after step. This is what Marxism-Leninism calls the dialectic relationship between absolute truth and relative truth. Such examples abound in the history of development of natural sciences. Therefore, developing democracy and letting a hundred schools contend seem to be very important in the realm of natural sciences. As Chairman Mao said: "Human history is a history of continued development from the realm of necessity to the realm of freedom, and this history will never end."

IV. Guiding Principles for the Distribution and Utilization of Scientific and Technical Cadres

We must thoroughly implement the principle of consistency between learning and application and the use of strong points. We must arrange things uniformly and equipment facilities in a key way according to the needs of national economic buildup and the needs in the development of scientific and technical endeavors. We must implement the policy of combining planned distribution and employing superior candidates and prevent a waste of talent. In distribution and employment, the main problems that exist at present are the stifling of real talent, suppression of talent, using people not trained in the discipline and using people who are not proficient in the tasks. Our guiding principle is to make learning and application consistent and to employ people skilled in the task. But in view of the present situation, to achieve this requires a lot more work and some problems in ideology and in the system must be solved. A main fault at present is the "unit ownership system" and the "life time duty system." After a scientific and technical cadre is assigned to a post, he can never move again and he can never be transferred. Some units tell scientific and

technical cadres: "This unit of ours only allows you to enter but prohibits you from leaving." Some units are "places with three generations under the same roof." The teacher of one academic school teaches his students, and his students teach the next generation of students. Some people call this "in-breeding" and this is unfavorable to scientific development. The method of hybridizing different academic schools is good, and it is called "distant cross breeding." Different schools of thought must learn each other's strong points to make up for shortcomings, study together, and allow a hundred schools to contend. This is beneficial to academic development. In some nations, schools send their graduates to other places to work first for a while and then allow them to return. We must change the situation of having pools of dead water and the lack of mutual exchange, and we must also prevent liberalization as in capitalist nations. In capitalist nations, "everything is oriented toward money." One goes to wherever more money is offered. You undermine my foundation and I undermine your foundation. We must never learn the liberalization in capitalist nations. Now, some people have criticized us as a pool of dead water. On the one hand, they advocate complete liberalization like capitalist nations. We cannot do so. We cannot advocate free mobility. This is not the policy of our socialist nation. At present, the talented people who have been stifled and who have been wasted generally have true talents and real knowledge. They have the strength but they cannot utilize it. They have gradually wasted away what they have learned, and they have gradually changed from a professional to a nonprofessional. Everyone knows, because the development of natural science changes with each passing day, according to a Japanese saying, if research does not continue for 5 years, then 50 percent of the original knowledge will be out-dated and will have to be abandoned. If one does not learn in ten years, the percentage of knowledge that is out-dated and that has to be abandoned will be 100 percent. Professionals will become nonprofessionals. As we have frequently said, "learning is like navigating a boat against the tide, if it does not progress, it regresses." Some units have talented people who are not being used. And yet they cannot be transferred elsewhere. They say this is "reserving talent for future use." On the one hand, talent is lacking and on the other hand, talent is left unused. This situation must be appropriately solved.

V. The Basic Attitude in Treating Scientific and Technical Cadres

We must fully trust scientific and technical cadres, employ them with a free hand, make strict demands and help them enthusiastically. The leadership at each level must respect science, actively support their rational suggestions and creations and inventions. The opinions of scientific and technical experts regarding major projects of socialist construction and major scientific and technical measures must be solicited, and scientific and technical experts must be organized to propose scientific proof and technical plans before decisions are made. We must guarantee that scientific and technical cadres, especially those in charge of technical management duties, have duties and authority and responsibility. Those scientific and technical cadres who have complex family and social relationships and who are marked by political and historical problems should be assigned work according to their own basic political attitude, their actual performance and their contribution to socialist construction so that they can develop their strong talents. The

basic attitude in treating scientific and technical cadres is summed up in these 16 characters: "trust them fully, employ them freely, make strict demands, help them enthusiastically." These include political ideology, work demands, training and education. life benefits and welfare and many aspects. First, we must recognize that they are a part of the workers and they are the forces that the Party relies upon. Some people have said that scientific and technical personnel "can be employed but not relied upon" and that they do not matter. This is pure utilitarianism. If you do not trust someone, do not employ him, if you employ someone, do not distrust him, if you employ him, you should trust him. When deciding major projects, expert opinions must be listened to. Now, the Central Committee is emphasizing that the leadership at each level should invite scientists to serve as advisers and it should organize counselor corps and adviser groups. They should be invited to present arguments and proofs of scientific and technical problems and propose plans. When employing scientific and technical cadres to serve as advisers or as leaders, we must guarantee that they have duties and authority and responsibilities. This means to give them fixed duties, fixed authority and fixed conditions and to make them shoulder definite responsibilities. In the future, we must establish a strict responsibility system. When the task is not completed within the scheduled time, they must be responsible. The Temporary Regulations for Evaluating Engineering and Technical Personnel issued by the State Council emphasize two stipulations: One stipulates that the criteria for evaluation is based on only three conditions: work achievement, the scientific and technological level; the working ability. These three are the major bases for evaluation. The other stipulates that experts should organize evaluation committees and the evaluation committee should evaluate personnel to judge whether the worker is up to standard or not, and the party and administrative leadership should give approval according to the experts' decisions. Of course, if it is discovered that the evaluation committee has not done things accordingly, investigation must be carried out. According to our understanding, many units have not implemented these two stipulations sufficiently well, and job evaluation has not been done according to this condition but by seniority and by the number of years of work, and people who have not worked in natural sciences have been evaluated as engineers. The masses call them "political engineers." Some units did not follow regulations in their evaluations. They are wrong and they do not seek truth from facts. They will detach themselves from the masses.

VI. The Question of Assigning Assistants to Experts

We must assign capable assistants to scientific and technical experts who have made achievements to help them better complete their scientific and technical tasks. In selecting assistants, the personal opinion of the experts must be solicited. We must guarantee that scientific and technical cadres work five sixth of the week to prevent them from taking up too many concurrent jobs. We must reduce or exempt them from administrative tasks and general social activities as much as possible. According to need and possibility, we must provide necessary books, information, instruments, facilities and working and learning conditions for scientific and technical cadres. We must actively help solve the actual difficulties in their lives. Scientific and technical

backbone members who have realized outstanding achievements must be taken care of on a priority basis.

The question of assigning assistants mainly involves finding ways for the academic skills of outstanding scientists to be passed on to the next generation. First, the expert himself can select and recommend an assistant and this assistant must inherit the expert's skills. Therefore, the assigned assistant must enable the expert to do his work well. The relationship between these two persons must be congenial. The teacher is willing to teach and the student is willing to learn.

Regarding the problem of too many concurrent jobs, the problem of a renowned scientist who is being sought here and sought there must be appropriately solved. Some experts hold administrative and leading duties, honorary duties and academic duties totaling 20 to 30 titles and all of them are "lifetime posts" without tenure. Experts feel that they are too busy and they are bothered. Experts say: "I hope you can guard against such activity because when we are asked to take up a duty, we do not feel we should refuse the offer. Meetings continue without end, there are many duties, and there is no time for academic research." The central spirit of the several opinions we have proposed is to develop advantages and avoid shortcomings, to utilize skills, and to suit measures to the person so that each can be comfortable in his own niche. Honorary positions can be reserved as the highest duties without concurrently serving lower level duties. Interdepartmental administrative and leadership positions should not be concurrently held. More academic duties should be given to middle aged backbone members, and not every position should be given to old scientists to serve concurrently. Middle aged scientists should be fully allowed to participate in academic conferences and to participate on councils and boards. Necessary conditions must be provided them in work, in learning and in living, and at least five-sixth the time must be guaranteed for them to engage in research.

VII. Training and Improvement of Scientific and Technical Cadres

We must implement the guiding principle of combining appropriate proportional distribution and suitably matched specialization, general improvement and key training. We must pay attention to the rational proportion of high level, mid level and primary level scientific and technical cadres, and the suitable matching of specialization among basic sciences, technical sciences and applied sciences. Job training of scientific and technical cadres not only includes self-learning but also many other methods. Training of youths, national minorities and scientific and technical cadres promoted from workers and farmers must be intensified and we must care about their growth. Persons who have special talents and who have scored high grades should be listed. Special training plans should be drawn up for them and they should be given better working and learning conditions for training them in a key way.

This is our policy and method to train and improve scientific and technical cadres. In general, in the guiding principle of training, we must have an appropriate proportion. Specializations must be suitably matched. We must implement general improvement and key training. Some cadres have an incorrect

understanding of continual on the job training and improvement. They believe that the school is the learning phase. The period after graduation is the working phase. Actually, the knowledge and skill of a scientific and technical cadre learned in school constitutes only 10 percent. The remaining 90 percent are learned in work and practice after graduation. Therefore, we must advocate "life-long education." Our nation has already included on-the-job training of cadres in the daily business agenda. In 1981, the general task proposed at the national workers educational work conference convened by the State Council was training for all workers. Training for all workers includes four groups: the first group is the leading cadres, the second group is managerial personnel, the third group is technical personnel and the fourth group is workers. This means, workers of each department, each enterprise unit, each agency group must be trained in general. The four aspects must be implemented: ideology must be implemented, plans must be implemented, organization must be implemented, measures must be implemented. We must not "say they are most important, but regard them as secondary in importance when implementing them, and when they are busy, abandon them." The guiding principle in work is: "Training for all, bring out the key points, uniform planning, delegation of responsibility to different levels, active development, do things according to one's capabilities, be diversified, care about concrete results." Comrade Deng Xiaoping said at the Central Committee's Working Conference: "Readjustment is an active measure that must be implemented to realize modernization. Training is an important aspect of such an active measure."

VIII. Organize Coordination and Exchange of Scientific and Technical Cadres in the Three Sectors of Scientific Research, Education and Production

The administrative departments of scientific and technical cadres at each level must organize coordination, cooperation and exchange of scientific and technical cadres in scientific research, education and production according to plan. They can also sign contracts or employ such personnel so that scientific and technical cadres can learn from each other, exchange experience, learn other's good points to make up for one's own shortcomings, and improve together.

Many units have created very good experiences by doing things this way. Many units have launched such activities among themselves and the scope of cooperation has become braoder. Departmental and regional boundaries can be broken because the development of science and technology requires comprehensive research in many aspects by various different sciences.

IX. Establish Job Performance Files

Administrative departments of scientific and technical cadres must establish job performance files on scientific and technical cadres in accordance with their scope of administration. The file includes the resume, job history, writings and academic papers, evaluation of creations, inventions and technical renovations, job evaluations, participation in foreign scientific activities, achievement in training talent, job rewards, etc., to serve as an

important reference for evaluation, for recommendation and for promotion.

This problem is a problem of much concern for scientific and technical cadres. Some scientific and technical cadres have told me: "Now, the files on cadres only list our political performance, and you do not know the level of our work and how many bowls of rice we eat." Therefore, they are very concerned about establishing a job file and this work must be done well.

The nine aspects mentioned above are some concrete guiding principles for work and major measures for managing scientific and technical cadres at present. The general goal is to fully develop the enthusiasm and creativity of the entire team of scientific and technical cadres so that the maximum effort can be exerted and greater contributions can be made to further readjust the national economy, to rapidly develop science and technology, and to hasten the realization of building the four modernizations. Efforts must be exerted so that there will be an abundance of talented people and an accumulation of achievements.

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STRATEGY FOR DEVELOPMENT OF SCIENCE, TECHNOLOGY VIEWED

Shanghai WEN HUI BAO in Chinese 23 Apr 82 p 3

[Article by Xia Yulong [1115 4416 7893], Liu Ji [0491 0679], Feng Zhijun [7458 0037 3182], and Zhang Nianchun [1728 1819 2797]: "We Should Praise the Type of 'Priceless Treasure' of 'Goldbach's Conjecture'; We Should Pay More Attention to Technology--the 'Valuable Treasure'--for Creating Economic Values for Society; Discussing the Strategy for the Development of Science and Technology"]

[Excerpts] "Science and technology are parts of the productive forces" and "the modernization of science and technology is the key to the realization of the four modernizations." These glorious theses of the party Central Committee are now known to everyone. However, how do science and technology serve the national economy and how do they effectively demonstrate their productive forces? This question is now prominent on our daily discussion agenda. If this question is not properly answered, it not only will seriously affect the progress of our country's modernization but also will directly affect the future of science and technology themselves. We believe that in order to solve this problem it is necessary to understand more clearly the policy established by the party Central Committee and State Council for coordination between science and technology development and economic and social development. The development of the national economy should be the primary task of science and technology. A strategy for the development of science and technology that reflects this policy should be established, consistent with our national conditions and the laws of science and technology development, so that it will direct our country's science and technology work now and in the future.

Differentiate Between the Functions and Effects of Science and Technology

The words "science and technology" are now widely used as a single term. In actuality, they embody two concepts of different meanings. In the Latin dictionary, science has the meaning of "knowledge" and "understanding." Scientific research is a social movement exploring the essence and laws of nature. It generally covers the six major sciences of mathematics, physics, chemistry, astronomy, earth sciences, and biology. The original meaning of technology is "proficiency." Proficiency produces skill and skill is technology. The solving of problems of widespread significance in production and labor, from technical invention, research in product manufacturing, to the promotion of application, is all part of technological research. Following the

development of modern science and technology, the relation of the two is closer and closer. The so-called "technologicalization of science" and "scienceization of technology" are being accepted more and more. However, they do have different functions and effects. Generally speaking, these differences are in the following areas: first, they have different forms. Science is expressed primarily in the form of knowledge. Technology always is in a definite material form. Second, the objectives are different. The primary objective of science is to understand the world. It primarily answers the questions of "what" and "why." The objective of technology is to reconstruct the world. It primarily solves the problems of "what to do" and "how to do it." Third, the methods of topic selection are different. Science is mainly reflected in free exploration. On the other hand, technology generally always has a clearly defined practical target. Fourth, the time frame of research is different. In scientific tasks, a completion date should not be insisted upon. But there is generally a concrete time frame for all technological research. Fifth, the economic benefits are different. The economic benefits of scientific research are not specifically determined and are long-range. Direct and specific economic benefits can always be achieved in technological research. Despite the close connection of science and technology, a definite or an inevitable relationship does not exist between them because of these differences. That a country is well developed in science does not mean that it is also ahead in technology. The opposite could also be true.

Only by differentiating between "science" and "technology" can we handle correctly their internal relationships and external connections and achieve the coordinated development between science and technology and between science and technology and economy and society. This is the basic prerequisite for the establishment of a strategy for the development of science and technology.

Consequently, for science, we cannot put into practice a policy of urgent success and quick benefits. We cannot strictly demand short-term economic benefits and values in commercial products. The experience of scientific research has shown that the results of its practical application can only be achieved after many years. From this, we can therefore see that if our country wants to achieve modernization by the end of this century we cannot put our trust in science alone. We must pay important attention to the research and development of technology. The vigorous development of research in new skills, new products, new technology, and new processes in the fastest way to shorten the period of time for reaching the advanced world levels.

To put it succinctly, our strategy for science and technology must begin with the total requirement of realizing the four modernizations. We must differentiate the functions and effects between science and technology, thereby correctly establishing short-term, mid-term and long-term objectives and policies and carrying out fruitful research in order for them to make a contribution in expediting the development of our national economy.

We Must Start With National Conditions

The current conditions demonstrate that our country is backward in science, backward in technology, and also backward in equipment. They all need urgent development, requiring investments in manpower, funds, and materials. However, China's economy is also backward. Funds are not adequate, materials are limited, and qualified personnel are also in short supply. They cannot satisfy the requirements for various investments. This is a contradiction. On the one hand, to change our economic backwardness as rapidly as possible also depends on science and technology. Thus, a cycle of contradiction has been created. The key problem is how to use our limited personnel, funds, and materials to the best advantage and develop the pitting one against ten." Obviously, we cannot immediately stand side by side in modernized science and technology with advanced countries. However, exactly how they have relied on science and technology for their modernization, and their experiences and lessons are worth our conscientious study.

England was the earliest country to become modernized. It is the birthplace of the Industrial Revolution. Relying on steam engine energy and other technology, it was at one time a large industrial nation with great influence. However, it has declined since the turn of the century. In the 1950's it was barely able to remain the second strongest nation in the capitalist world. By the 1960's it had fallen rapidly to the fifth position. By 1980 its position was second to last among the seven European countries in terms of per capita national production. Is this because England's level in science is too low? No. England has traditionally paid important attention to science since the 16th century and great names in science have appeared generation after generation. Even today, when computed on the population average, it is still the country with the largest number of Nobel Prize winners. What then is the cause for its decline? The reasons are many. However, a misguided policy in science and technology must be mentioned as one of the important reasons. Many scholars abroad have pointed out: "Although England's basic science is still advanced, their application of technology is poor." This statement is quite reasonable. In recent years, the science and technology sector of England has begun to reexamine itself. In 1979 the Commission for the Advancement of Science of England called a conference specially to discuss the problem of coordinated development of science and technology. The goal of the conference was clearly spelled out across the chairman's platform: Technology--Our Future.

Science and technology in the United States were born during the War of Independence. They grew in strength during the Civil War and matured during World War II. They have achieved full development since the 1950's. The United States has always been well known as a land of practical people. It devoted its entire energy in the early days to technological research and application and it is exactly through the reliance on its strength in technology that it has maintained its position as the world's economic giant ever since 1980. However, the United States did not achieve its leading position in science until after World War II. During the war, famous scientists from Europe and all over the world went to the United States. Also the highly developed military technology has urgently demanded the development of new

avenues through scientific research. The then head of the Bureau of Scientific Research, presented his famous report to the President, advocating the increase of investment in scientific research. The "artificial satellite effect" of the Soviet Union in 1957 particularly gave the United States a very strong stimulus. During 1958-60 the budget for the National Science Foundation suddenly increased by more than three times. From then on, science in the United States progressed and developed and the number of Nobel Prize winners jumped to the leading position in the world.

After World War II, the Japanese economy collapsed completely. And now after only a few years, it is economically the second largest country in the capitalist world. Japan's level in science is not high. The number of Nobel Prize winners can be counted on one's fingers. What strength did Japan depend on to push its economic recovery? Not long ago, the report of a study by the British Government pointed out that Japan treated "the concerted use of technological development by the entire country as the absolute road to economic recovery." Using the words of the Japanese themselves, they chose "national construction through technology" as their strategy for development. Simultaneously, with the steady development of basic research, they paid particular attention to applied technology to improve their competitive market power and to improvements in technology for product quality, technology in productive skills, and synthesis technology. They not only imported advanced technology from abroad but also vigorously developed their own technological research. Through analysis and synthesis, they created first rate products in the international markets and the country achieved modernization within the short period of 20 years.

In summary, we can reach two conclusions that could be used for reference:

1. Although the conditions in the countries were different, in their early stages of modernization they all followed the road of emphasizing the development of technological research and relied on the development and application of technology rapidly to upgrade their national economy.

2. Basic scientific research should be strengthened after the economic strength and technological foundation have reached a certain level. By that time, coordinated development in rational proportions should be maintained for science and technology. However, even then, the superiority of technology cannot be neglected.

Place Selective Emphasis on Research of Applied Technology

Without selective emphasis, there is no policy. In studying our country's development in science and technology, what are the foreseeable emphases? This is the key in establishing a strategy for the development of science and technology. We believe:

1. Basic research should be done, but emphasis should be placed in the research of applied technology and in the development and application of technology. Basic research should be maintained at a steady ratio and gradually increased as the economy develops.

2. Sophisticated research should be done, but emphasis should be placed on the development and application of productive technology. Technological development and research for product development should be used to promote economic development, especially in technology that is closely related to the clothing, food, lodging, and travel of the people. They should be used to promote the development of agricultural productive forces and diversified economy and to promote the technical reconstruction and the technological innovation of existing enterprises.

3. Creative research should be done, but emphasis should be placed on absorbing the technologies which are already established abroad and which are suitable to the practical needs of our country and adopting them to our needs through technological research, digestion, synthesis, and creativity.

The above three points may be summarized in one sentence: emphasis should be placed in the research of applied technology. This is the strategy that we need for the development of science and technology.

Of course, all scientific research cannot be treated in the same manner. Many subjects which are closely related to technological development should be given greater attention, such as applied mathematics, surface physics, etc. All technological research cannot be treated in the same manner either. The "technology secrets" that cannot be imported from abroad should become the emphasis for research.

If this development strategy is correct, aside from adopting appropriate measures in investment, the policy must still receive systematic implementation, changing current conditions which are not entirely rational.

1. In the work of propaganda, attention should be given to the coordination of relationships between science and technology. In the work of publicizing the role of science and technology, very good results have been achieved in recent years. However, greater publicity has been given to basic sciences, especially pure mathematics, theoretical physics, etc. This has created a wrong impression, that the economy will prosper and the four modernizations will be realized with progress in these sciences alone. Many superior youths are taking mathematics and physics as the objective of their struggle. (For instance, in the Physics Department of the Fudan University alone, there are over 1,100 students, representing 1/5 of the school's total enrollment.) On the other hand, superior students are not easily recruited for such specializations, which are urgently needed for the establishment of the four modernizations, as agriculture, geology, chemical engineering, hydraulics, management, economics, and law. This situation is irrational.

2. In the area of social position and remuneration, attention should be given to the improvement for personnel engaged in applied technology work. The social position and remuneration of our country's scientists and engineering and technical personnel have had some improvements in recent years. However, in contrast, the position of engineering and technical personnel is not consistent with their role for the four modernizations.

3. In the area of evaluation and promotion, there should be some differentiated treatment. It is very good to note that among the scientific personnel in our country a group of researchers, assistant researchers, professors, and assistant professors have been promoted in recent years. However, the number of engineering and technical personnel promoted to senior engineers has not been large. We believe that in the evaluation and promotion of engineering and technical personnel the quality of their papers and their foreign language abilities should not be the only criteria. Their ability to solve practical problems and their contribution to the creation of economic values should be the primary standards.

In summary, we should praise the type of "priceless treasure" of "Goldbach's conjecture." At the same time, we should double our emphasis on the "valuable treasure" which creates economic values for society--technology. By this walking with two legs, science and technology will be able to push forward economic development on an even better basis. And science and technology will also achieve their own splendid future in economic development.

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QIAN XUESEN: ALL SCIENCE EVENTUALLY CONVERGES ON MARXIST PHILOSOPHY

Beijing ZHEXUE YANJIU [PHILOSOPHICAL RESEARCH] in Chinese No 3, Mar 82 pp 19-22

[Article by Qian Xuesen [6929 1331 2773]: "The Structure of Modern Science--a Rediscussion of the Study of the Scientific and Technological System"]

[Text] In my previous discussion of the systematic structure of modern science and technology (see footnotes 1, 2, 3 and 4), I felt that, from application to basic theory, modern science and technology may be divided into four levels: first, the level of engineering technology; then, the the level of technological science serving directly as the theoretical basis of engineering technology; thereafter, the level of basic science; finally, by means of further synthesis and purification, the Marxist philosophy, the supreme epitome. The division may also be regarded as four steps, or a horizontal division, from the practical technology to remold the objective world to the supreme philosophical theory. The vertical division is the classification of academic subjects into categories. According to the general view, the large categories are natural science and social science. China now has the Chinese Academy of Sciences and the Chinese Academy of Social Sciences and their branches in the various provinces, municipalities and autonomous regions, the two systems. Nevertheless, I feel that, if we consider the present situation and future development of science and technology, the large vertical categories should be natural science, social science, mathematics, systematic science, cogitative science and the science of the human body, a total of six. How do we regard these six categories? What are their dividing lines? Generally speaking, they are all parts of the knowledge of the laws of the objective world gained through practice. The traditional view is that the categories of science are divided according to the realms of their objectives, with nature the objective of natural science and the human society the objective of social science. However, there is a flaw in such division: As mathematics is a natural science, it is seldom applied in social science. This defect has been recognized by many people.[5] It leads me to reexplore the issue of the structure of modern

science and technology: How are the six large categories divided? Do we divide them according to the realms of their objectives? Or is there another way?

This article expresses some views on the issue for discussion, criticism and correction by my comrades.

I. Though the range of study of natural science was the world of nature in the 16th and 17th centuries, actually, after the 18th century Industrial Revolution, it was no longer limited to nature. Physics, chemistry, biology, astronomy, geoscience and other numerous technological sciences and engineering technologies in today's natural science involve the entire objective world, both natural and man-made. Of course, natural science has its characteristic, which is the focus or angle from which it views the objective world. It is the central idea of natural dialectics advanced by Engels approximately a century ago: the study of the motion of matter in time and space, the different levels of the motion of matter, and the interrelations of the motion of matter at the different levels. To summarize it again, natural science observes the entire objective world from the focus, or the angle, of the motion of matter. When a natural scientist looks at a machine manufacturing plant, he does not focus on its finances, operation and management, and economic conditions, but regards it as a place of material flow and of processing and cutting, and studies its energy consumption, the wear and tear of its machinery, and the quality and function of its products.

As the focus of natural science is the motion of matter, its study cannot be separated from quality, length and time, the three quantities, known as the basic dimensions. Other quantities emerging in the large category of natural science are all formed by the three basic dimensions. The application of this crucial fact results in an extremely important method of study in natural science, known as "dimensional analysis," and it often enables us to see clearly the mechanism of matters. For instance, the constant, quality and light velocity, the three quantities of gravitation, cannot form a numerical value without dimensional analysis, because length is missing, and length is the radius of the so-called "black hole" of a given quality. Nevertheless, unrelated to the three basic dimensions of natural science, the quantities of social science have nothing to do with length, quality and time, or their combinations. Therefore, from the angle, or the focus, of the motion of matters, we can distinguish natural science from other large categories. For the same reason, we should consider natural dialectics the bridge from natural science to the Marxist philosophy.

What is the characteristic of social science? From what focus, what angle, does social science study issues? As I suggested previously,[2] the bridge from social science to the Marxist philosophy is historical materialism. Thus, it reveals to us that the focus, or angle, of study of the objective world in social science is the development motion of the

human society, the internal motion of society, and also the influence of the objective world on the development motion of the human society, such as environment, ecology, energy, resources, etc. People may say that, if so, one cannot claim that social science takes the entire objective world as the objective of study, as the human society only exists on earth! However, let us take a look backward. Only a few hundred years ago we were unaware of the existence of earth, and thought that society only existed on a small square piece of land with the sky as the dome! Yet now we have learned that the motion of the sun influences our economy, because it affects the climate and wireless communication on earth. As for the future, the social activities of mankind will, by means of the technologies of spaceflights and flights in the universe, expand to the entire solar system and beyond. How can we say that social science does not study the entire objective world?

Therefore, we may say that social science studies the entire objective world from the focus or angle of the development motion of the human society, and that the bridge from social science to the Marxist philosophy is historical materialism.

II. Regardless of which branch, modern science and technology cannot be separated from mathematics, from one or more subjects of mathematical science. Therefore, that mathematical science is the study of the entire objective world is easily understood. What we want to discuss is the focus or angle from which it studies the objective world. Comrade Hu Shihua [5170 0013 5478] has written an article on this issue.[6] He says that the philosophical basis of mathematics is the opposite unity of quality and quantity and their mutual transformation. I agree with this view. The remaining work is to intensify this concept from the methodology and historical development of mathematical science and enrich its substance, making it into a field of learning, a bridge to the Marxist philosophy. Comrade Hu Shihua has done some work,[7] but he says that he will pursue it further. Comrade Ouyang Jiang [2962/7122 4829] has also brought the issue up,[8] and calls it the science of mathematics. Thus, the views of everyone have been centralized, and the work of building a bridge from mathematical science to the Marxist philosophy should be started.

III. I have already discussed systematic science in my previous article.[3] The characteristic of systematic science is the systematic view, or, one may say that it is to regard the entire objective world from the systematic focus or angle. Therefore, the issues handled in systematic science include issues of nature, such as the sequential phenomenon in biology and social issues, such as the economic system, the legal system, etc.[9] As they are unified in the systematic view, if it is said that the systematic theory is the bridge from systematic science to the Marxist philosophy, then the systematic view is a component of Marxism.

Cogitative science, since its proposal, has aroused the interest of many comrades. As the basic work in this aspect is still very inadequate and

only the study of logical thinking is fairly thorough, unanimity in understanding is still difficult to reach. Man's thinking under conscious control is classified into logical, imaginal and inspirational, its three forms, divided according to the different inherent laws of thinking. Some comrades seem to confuse them with the various different components in the thinking process and propose emotional thinking as a sort of artistic thinking.[10] If so, then we can also propose "writing thinking," "scientific research thinking," "creative thinking,".... Such classifications are actually the process of the application of the three cogitative activities in a certain aspect, including one or more of them in each process. Therefore, emotional thinking is not a basis of cogitative science, but its application, and should not be juxtaposed with logical, imaginal and inspirational thinking. Another problem is the confusion in the terminology of the three basic cogitative activities: Logical thinking is also known as abstract thinking, while imaginal thinking seems to be familiar to comrades in literary and artistic work, but not in the field of science. Scientists are accustomed to use the term heuristic or physical as a distinction from logical and mathematical. Comrade Zhang Guangjian [1728 0342 7002] proposed the term "similarity thinking."[11] Actually, according to my own experience, these terms all indicate imaginal thinking. As for inspirational thinking, the characteristic is its suddenness, and it may be described in the Buddhist term of "sudden enlightenment." For the convenience of discussion, we may call the three kinds of basic thinking abstract (logical) thinking, imaginal (heuristic) thinking and inspirational (sudden enlightenment) thinking.

How can we say that cogitative science studies the entire objective world? Because the goal of cogitative science (see footnotes 3 and 4) is to understand how man interprets the objective world and how he stores and processes in his brain the perceptual information gained in practice and turns it into his interpretation of the objective world. It is also for this reason that thinking is linked with the entire objective world, and that epistemology is the bridge from cogitative science to the Marxist philosophy. Naturally, with the development of cogitative science, the epistemology discussed here will also greatly develop and intensify, no longer limited to the classic epistemology. Classic epistemology has not epitomized the detailed knowledge of man's cerebral activities; therefore, it does not have the foundation of the new cogitative science which will develop, but remains in the stage of cogitative discrimination, with fairly great limitations. Though the accuracy of quantum mechanics, for instance, had been verified in experiments, by starting from classic epistemology in the past five decades or more, controversies were touched off,[12] which have remained unsolved till today, leading to the peculiar "many-worlds theory" of H. Everett, B. S. Dewitt and N. Graham.[13] It appears that the issue can only be solved alongside the study of cogitative science and the new development of epistemology.

The science of the human body is a branch of the ancient yet novel science and technology.[4] Ancient because many of its subjects, with an extremely rich substance, have long been established, and our understanding of the

entire science of the human body has its source in China's ancient tradition, such as Chinese medical theories and the system of deep breathing. The currently controversial unique functions of the human body have only gained serious attention in China in recent years. On the other hand, the science of the human body is very novel. By bringing to light China's ancient tradition, it is given a new direction. In other words, man is considered an entirety, to be placed in the whole universe for study and to be linked with the universe. It is the new concept of man and nature. The climate, the sun, the moon and the entire universe influence man, while the human body will also influence the external world. Therefore, the science of the human body is to observe the entire objective world via the focus or angle of the human body. Not only the various components of the human body cannot be observed separately, but the human body and the external world cannot be considered separately. The concept of man and nature will also become a component of the Marxist philosophy, while the "theory of man and nature," synthesized and purified through the further development of the science of the human body, will be the bridge from the science of the human body to the Marxist philosophy.

The foregoing is my view on the structure of modern science. Natural, social, mathematical, systematic and cogitative sciences and the science of the human body, the six large categories, each interpret the entire objective world, except that each observes the world from its own focus or angle, natural science from the motion of matters, social science from the development motion of the human society, mathematical science from the opposite unity of quantity and quality and their mutual transformation, systematic science from the systematic concept, cogitative science from epistemology, and the science of the human body from the concept of man and nature. Observing from different focuses or angles, each finally builds its own bridge and all converge on the Marxist philosophy--the supreme epitome of man's understanding. Therefore, only the Marxist philosophy is the scientific philosophy; naturally it must guide scientific and technological research. Thus, modern science forms into an inseparable and solid unified system, the system of modern science and technology. The further study of this system is the task of the scientific and technological system.

Is this view right? Should we not explore it further?

January 1982

FOOTNOTES

1. Qian Xuesen, "the Study of Science, the Study of the Scientific and Technological System, and the Marxist Philosophy," ZHEXUE YANJIU, No 1, 1979 pp 20-27

2. Qian Xuesen, "on Establishing and Developing the Study of the Marxist Science," KEYAN GUANLI [SCIENTIFIC RESEARCH MANAGEMENT], No 1, 1980 pp 1-6

3. Qian Xuesen, "Natural Dialectics, Cogitative Science and the Potential of Man," ZHEXUE YANJIU, No 4, 1980 pp 7-13

4. Qian Xuesen, "Systematic Science, Cogitative Science and the Science of the Human Body," ZIRAN ZASHI [NATURE MAGAZINE], No 1, 1981 pp 3-7

5. Liu Wen [0491 2429], "Social Science Must Also Modernize," GUANGMING RIBAO, 8 Dec 81 p 3

6. Hu Shihua, "the Opposite Unity of Quality and Quantity in Mathematics," ZHEXUE YANJIU, No 1, 1979 pp 55-64

7. Hu Shihua's talk

8. Ouyang Jiang, "Preliminary Exploration of the Science of Mathematics," academic paper at the first annual meeting of the China Natural Dialectics Society, 1981

9. Qian Xuesen, "Vigorously Develop Systematic Engineering; Establish Systematic Science as Soon as Possible," GUANGMING RIBAO, 10 Nov 79 p 2; also in "Collection of Academic Papers on Systematic Engineering," Science Publishing House, 1981 pp 1-7

10. Huang Zhizheng [7806 3112 2973] and Yang Anlun [2799 1344 0178], "on Emotional Thinking--a Conception of Man's Thinking, Especially Artistic Thinking," QIUSUO [SEARCH], No 3, 1981; also in XINHUA WENZHAI [XINHUA DIGEST], No 10, 1981 pp 167-171

11. Zhang Guangjian, "a Discussion of the Study of Similarity," QIAN KEXUE [LATENT SCIENCE], No 3, 1981 p 39

12. F. Jammer, "the Philosophy of Quantum Mechanics," John Wiley and Sons, 1974

13. B. S. Dewitt and N. Graham, "the Many-Worlds Interpretation of Quantum Mechanics," Princeton University Press, 1973

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MARXISM HELD CRUCIAL TO DEVELOPMENT OF 'SCIENCE OF LEADERSHIP'

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese, No 1, Jan 82 pp 38-40

[Article by Li Ruiying [2621 3843 5391] And Shi Yanjiu [4258 8827 3773] of the Theoretical Department of GUANGMING RIBAO, edited and released by Ren Zhenjiang [0117 2182 3068]: "The Research Subjects of Science Led by Marxism"]

[Text] The proletariat acquired its own complete system of thought and revolutionary theory only after the birth of Marxism. Under the guidance of this great theory, the proletarian revolution and construction were gloriously carried out. If we say that an important characteristic of Marxism is its pragmatism, then, it is only possible to truly, fully and systematically practice Marxist theory under conditions of socialism. This is because the social practices following the success of the proletariat revolution and the social practices prior to the revolution are very different in content, form, depth and broadness, for example, the practice of political leadership to strengthen proletariat dictatorship and consolidate the socialist system, the practice of administrative leadership to readjust socialist production relations, the practice of vocational leadership to manage the socialist economy and science and technology. All of these practices and activities have trained the proletariat revolutionary, enabling him to accumulate a massive amount of precious work experience, and on the basis of these experiences, enabling him to create outstanding working methods and the art of leadership. The number of pages of writings on Marxism dedicated to the working method and the art of leadership, has increased. This is an attractive characteristic in the history of development of Marxism.

Therefore, the concrete application of the basic theory of Marxism in leadership work may possibly be the emergence of a brand-new applied theory out of the system of Marxist theories--the science of leadership.

The Marxist science of leadership can become a discipline because it has its own specific research subjects which are the general structure, model, process and laws of motion of leadership. Discussing the research subjects of the science of leadership has a definite practical and theoretical meaning in establishing a scientific leadership theory and in improving the level of work of leading cadres.

(I) The Research Subjects of the Science of Leadership

1. The Question of the Social Structure of Ordinary Leadership

The science of leadership, as a science of modern social management, is actually the discipline of understanding, adjusting and controlling the basic conflicts of society. The common term "social management" is the management of society's productive forces, production relations and superstructures via definite means. What we call leadership also refers to leadership in the various social sectors mentioned above, such as political leadership, administrative leadership and vocational leadership (including economic, academic and military leadership, etc.). Political leadership is mainly the management of the superstructure. Administrative leadership is mainly the management of personnel, logistical support, and public service policies which involve production relations (such as wage relations). Vocational leadership is basically the management of productive forces with the exception of a few superstructure sectors. Therefore, the science of leadership naturally forms three main branches in these three sectors: (1) the science of political leadership; (2) the science of administrative leadership; and (3) the science of vocational leadership.

Lenin once pointed out: "Politics is a science, an art; it does not fall out of the sky. It is not something we receive gratis." ("Selected Works of Lenin," Vol 4 p 247.) This means, the science of political leadership is not a record of the revolutionary enthusiasm of leaders or the manifestation of personal wills. It is a scientific theory that is consistent with the objective laws of political leadership.

For example, the question of the social status of social and political leadership under socialism is an important subject in the science of political leadership. Because conditions at the time when the nations began establishing socialism were different, the concrete form of transition from capitalism to communism necessarily was and should be varied. The characteristics of the nationalities were different, and there were regional differences, different characteristics of economic structure, different life styles and differences in ideological awareness of the people. Therefore, the concrete form of transition to communism in each country was different. This greatly influenced the general structure of leadership in society. Generally speaking, socialist nations frequently have as a leadership structure, a triumvirate leadership structure of "politics--administration--vocation" guided mainly by political leadership.

But it must be pointed out that emphasizing the main guiding function of political leadership does not in any way negate the basic function of vocational leadership. Marxism has always held that every socialist nation should regard the development of social productive forces as its own important historical task. The development of productive forces can never be separated from vocational leadership. At the same time, the nature of the socialist society determines that its economy is mainly planned and its management is mainly centralized. Therefore, a socialist nation relative to any nation of a different social system will abstain more from the antiscientific "vocational

"leadership," and it will abstain more from the "blind command" of subjectivism, because this type of antiscientific "vocational leadership" brings more severe losses to centrally managed nations than to nations under decentralized management. Many historical experiences and lessons have proven this point. It would be very dangerous not to advocate vocational leadership, or shall we say, if the political leadership does not take vocational leadership as the foundation, it would be very dangerous. Just as in the course of war, defeat is inevitable if the political leadership does not take military leadership as the foundation.

Administrative leadership is the intermediate link between political leadership and vocational leadership. Without administrative leadership, political leadership will not be able to develop an active function in vocational leadership. Like the superstructure, when it is separated from the medium of relations of production, it will not be able to develop its function as a productive force. The political and ideological work of the leaders can stimulate the enthusiasm of the workers, but this cannot be sustained for a long time. Political leadership also must rely on the medium of production relations, utilize appropriate adjustments in the ownership of productive information and utilize continued reformation of the relations in the distribution of the products of labor and various types of social relations to guarantee the conditions for reproduction by the labor forces, to stimulate and further heighten the enthusiasm of the laborers. In one statement, we must rely on administrative leadership which includes personnel, logistics and service departments to create definite social conditions for vocational leadership and to set up a firm bridge for political leadership to lead to vocational leadership.

The concrete structural forms of the three forms of leadership, political leadership, administrative leadership and vocational leadership vary with the different situation in each nation and with the degree of development of productive forces. But, political leadership (especially the central function of the proletariat political party) cannot be weakened. The task of the science of leadership here is to study the mutual relationship of the various types of leadership under different social conditions and to study the social structure and measures of social control necessary to realize this type of leadership structure.

2. The General Model of Leadership and Its Laws

In a class society, the process of leadership (especially political leadership) frequently has a strong class character. But, from the viewpoint of organizational effects, the question of the general structure and the model of leadership is a technical problem that does not have any class character. According to this viewpoint, the so-called "leadership" is a process and an action. Concretely speaking, it is a process of a special type of mutual action between individuals (the leaders or leading group) and the groups of people (political party, class and masses). It is also a self-conscious action that influences people to achieve a certain group goal. Such actions are all common actions that are led. Here, the individual emerges from the masses and he can control and influence the action of the group. The group is a social group

directed and influenced by individuals using different methods. Regardless of how different the methods of mutual action between the individual and the group, creating the greatest organizational effect and striving for the best social result are the consistent goals of leadership.

Because the methods of mutual action between the individual and the group are different, the general model of leadership is generally divided into the following types: (1) collective leadership and leadership at different levels; (2) individual responsibility and individual leadership; (3) direct interference and direct solution (Refer to "Selected Works of Zhou Enlai," Vol I, p 129). This means, the method of mutual action between the individual and the group in the process of leadership are of three types: "strata," "linear" and "tunnel" types. These three types are suitable for use in different situations. They are mutually independent but they are also mutually complimentary.

3. The General Process of leadership and Its Laws of Motion

If we say that leadership is the process of special mutual action between the individual and the group, then the information carrier to realize such mutual action is mainly policy. According to the different functions of formulating policy, centralization, decisionmaking, execution, and feedback, the process of leadership can be generally divided into five stages: (1) investigate and research stage; (2) formation of policy stage; (3) policy decision making stage; (4) policy execution stage; (5) examination and revision stage.

Investigation and research are the basic working methods in Marxism. They are also our starting point in establishing any policy. Because of the randomness of social phenomena and the uncertainty of social understanding, frequently, social surveys become very difficult and complicated. To discover problems and solve problems, people have divided investigation and research into two stages. The first stage is to carry out typical surveys to discover problems, i.e., "one-time survey and research." The second stage is to carry out systematic investigation to solve problems, i.e., "second investigation and research." Whether in "one-time survey" or in "second surveys," both should utilize the method of comprehensive analysis in systems theory to perform statistical analysis of the facts obtained. We must utilize fully the special functions of typical information, and we must also eliminate the limitations of typical information and exert efforts to extract statistical probabilities from typical information that have policy value. Therefore, investigation and research constitute a very complex discipline. The exploration of the laws of investigation and research by Marxism may produce a scientific theory for the science of investigation and research.

The conclusion of the stage of investigation and research signifies the beginning of the stage of policy formation. Because of the different positions and viewpoints of the investigators, and because of the different methods of processing investigative information, the conclusions are thus varied. The policy plans carried out to solve social problems will also be varied. What we call "policy formation" is gradually reached through mutual debate and the process of elimination. Debate frequently produces several coexisting plans in

a "multiple state" of policy plans. The "multiple state" of policy is an important characteristic of the stage of policy formation. It is also the necessary condition that the policy stage arrives. Without many plans, the question of the so-called "best selection" will not exist.

After debating and screening policies, the different policy plans submitted to the leaders should be said to be plans that will withstand scrutiny. In the view of planners, the plans coincide with at least the objective situation at the time of investigation. But, will they suit the overall situation, or shall we say, what effects will the plans have on the overall situation? The highest leaders who have the overall situation in their grasp must make the decision. For example, during the period of war, the leaders can sacrifice certain parts of scientific nature of the policy to satisfy the needs of political struggle or military struggle. These situations are all for winning the greatest success in work and the final victory in combat.

Promulgation of a policy is easy, but, whether this policy is executed correctly is fairly difficult. To correctly implement this policy, a lot of detailed work has to be done. Because policy is the reflection of the general laws of things, it cannot suit the actual situation of every locality. Therefore, we must first carry it out at "test points" and then carry it out on an overall basis. The so-called "theory of policy execution" is to study the method of combining the general and the specific and improve the maximum results of policy execution.

In the stage of policy execution, problems and shortcomings will necessarily emerge. To solve this problem, the leadership agencies must send people to the masses to inspect the execution of policy and to gather feedback on the policy, either to correct any deviation in the execution of the policy or to supplement and perfect already established policy. In this way, the feedback on the policy will return the leadership process to a higher level of investigation and research, and a new leadership process thus begins.

In general, the Marxist science of leadership should study the special laws of concrete leadership processes and establish the Marxist theory of investigation and research, the theory of policy formation, the theory of policy decisionmaking, the theory of policy execution and the theory of policy feedback. Expressed in one sentence, we want to establish the Marxist science of leadership.

(II) Alliance of the Science of Leadership and the Techniques of Leadership

We must emphatically point out that the study of the Marxist science of leadership does not signify a negation of the Marxist techniques of leadership. The techniques of leadership and the science of leadership are inseparable and they are two mutually complimentary sides. When we say that the techniques of leadership await being elevated to a science of leadership, we mean elevating the skills of leadership established on the foundation of traditional social science which can only be described by qualitative methods to a science of leadership which awaits being elevated under Marxist guidance and which is

established on a modern scientific and technological foundation that can combine quantitative analysis and qualitative analysis.

Perhaps some will think that when there is such a science of leadership, the leaders will not have to exert any mental effort. They can utilize the computer and sit back and enjoy the fruits of labor. Actually, this is a misconception. The science of leadership will never at any time and will not possibly become a "miracle drug" that will cure all ills. The science of leadership only exposes the laws of social leadership to let the leaders realize social policies by following scientific laws. Whether the policies will be of high standards or low standards still depends on the development of the leadership techniques of individual leaders. Therefore, social policy will not be separated from the techniques of leadership at any time. The greatest advantage of the techniques of leadership is its dynamism and creativity. It can utilize decisionmaking methods in a versatile manner according to the actual situation. Yet it is precisely because of this that the techniques of leadership also manifest one's greatest weakness, i.e., the so-called "abnormality." The same leadership technique used by different people will produce vastly different results. For example, disecting the sparrow (analyzing a microcosmos), learning at the locality, running about and such investigative techniques have been used by some people to make Marxist decisions while others have become advocators of subjectivism "armed with facts." Because the simple techniques of leadership are largely dependent upon individual talent, intelligence, aura, style of work of the leaders, therefore, in a certain region or at a certain unit, the normal transfer and replacement of leaders will frequently cause a change or interruption in the execution of policy and loss in work which should not have occurred. Thus it can be seen that it is not only a historical necessity for abnormal techniques of leadership to be elevated to become a normalized science of leadership, but at the same time, it is needed in building socialist modernization. We believe that further development of the science of leadership may produce higher level techniques of leadership which will include a fixed model of "software techniques" of leadership. The development from leadership techniques to a science of leadership and then from the science of leadership to techniques of leadership is an unlimited, repetitive and spiralling process of understanding. It is also a method of historical dialectics between the techniques of leadership and the science of leadership. All methods that separate Marxist techniques of leadership from the Marxist science of leadership are wrong.

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ACADEMY OF SCIENCES ROLE IN SCIENTIFIC RESEARCH REVIEWED

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[Article by Luo Wei [5012 0251] of the Policy Studies Office of the Chinese Academy of Sciences: "The Position and Role of Academy of Sciences in Chinese Scientific Research System"]

[Text] In 31 years of development history, the Chinese scientific research system has formed five branches: The Academy of Sciences, schools for higher education, industrial research organizations, local research organizations and defense research organizations. (In this article we shall only discuss natural sciences.) The Academy of Sciences is the highest academic organization and general research center in China; it mostly engages in the research of basic sciences and some technological sciences.

In the discussion of improvement of the system, many comrades have expressed their views on the merits and shortcomings of the present Chinese research system. One important aspect of the system is the status and role of the Academy of Sciences. Many comrades believe that the Academy of Sciences should be strengthened and constantly improved so as to play its full role as the highest academic organization, and take full advantage of its interdisciplinary nature in solving general and pivotal scientific and technological problems in China's national construction and make more contributions to China's modernization. There are also some comrades who believe that basic scientific research should be concentrated in institutes for higher learning, technological science research should be closely related to production departments and should therefore be combined into industrial research organizations so the Academy of Sciences would no longer be a research entity but an honorary and consulting organization. We wish to express some opinions regarding this question.

Scientific Research Is Gradually Becoming an Enterprise of National Scale

We first look at the historical development. Along with the growth of modern science, the principle form of organization in natural science research in the world, although different from country to country, has largely followed the progression from individual research activity, to college and university laboratories, to industrial research organizations, to national research

organizations and finally international research organizations. Furthermore, governments in various countries have also increased their intervention on the science enterprise in terms of organization, planning and expenditure.

Science has exhibited some of its characteristics in the process of development. First, it is increasingly society-oriented, it is becoming less and less likely to be conducted by one or a few individuals. Experimental research such as that conducted by Madame Curie is no longer playing a leading role.) Second, experimental methods are becoming increasingly sophisticated, extensive and complex. They are no longer within the financial reach of a few individuals or a single enterprise. Third, science and technology are moving in the direction of integration and breakthroughs often appear between disciplines and, in the meantime, many problems in science and technology are no longer solvable by knowledge in only one field. These characteristics dictate that scientific research gradually move toward a national scale. Although each country has a different mode, there are still some common features: (1) Government allocation makes up a relatively large fraction of the total national scientific research expenditure; 57 percent in the United States, 54.6 percent in Great Britain; 47.7 percent in West Germany, 42.6 percent in Japan and 55.8 percent in France (all 1975 statistics). (2) Basic research and major scientific and engineering projects are mostly supported by the state. (3) The state is increasing its guidance, coordination, support and funding for scientific research development. (4) Major research projects are often concentrated in national research centers and research organizations in various branches of the government.

In China, the research organizations of various industrial departments (including central and local governments and defense departments) are mostly engaged in development work closely related to the production assignments of the department or the region and some associated applied research. Long-term, fundamental, exploratory and theoretical research which cannot be applied to production now but are required by production development in the future and interdepartmental, interprofessional and interregional research which require the cooperation of many disciplines will have to be conducted by the state or by state-funded research centers. At present, this part of research in China is essentially placed in the Academy of Sciences and it also seems to be consistent with the international trend of science development.

Study Other's Experience and Choose Our Own Direction

An overview of the different research systems of major countries in the world shows two types of systems. In one system there are concentrated national research centers such as the Academy of Sciences in the Soviet Union and Eastern European countries, the Max Planck Institute and Fraunhoffer Institute in West Germany and the national research centers in France. In the other system, scientific research is distributed in colleges and universities, industries and various departments in the government, the state has no concentrated research centers and there are only honorary and consulting academic organizations such as the National Academy of Sciences in the United States, the Royal Society in Britain and the Institute of Scholars in Japan. There are a number of common features in the two systems. In the former, there are also a number of research organizations in the colleges, universities,

government departments and industries; in the latter, the government guides and coordinates basic research through policies and funding and large-scale science projects are in fact still run by the government.

It is still quite difficult to properly evaluate the advantages and disadvantages of the two systems because there are many factors affecting the choice between the two models including historical reasons, social system reasons, economic reasons and the factor of tradition. We should carefully study the characteristics of the systems and absorb useful experiences and we should not give preference to the model of some countries and lightly dismiss the model of other countries. Especially, we should not negate our own experiences and the foundation obtained through 31 years of practice with some foreign experiences. No matter in which country, there are always reasons to opt for a certain system. Generally speaking, a country is always trying to compensate for the shortcomings of its system by various means and is also constantly changing its system locally or globally based on the development situation. A system is not absolutely rigid and does not decide everything.

We need to make an analysis of our own situation. In 1928, China established its Central Institute of Research. One month after the birth of the new China, the Academy of Sciences was established on the basis of the takeover of the Central Institute of Research and the Peiping Institute of Research. Although the Academy of Sciences was small at the time, it had the best scientists in China. Research organizations in industrial and defense departments were almost nonexistent at that time. Many institutes for higher learning had little or no scientific research. Hence, the absolute majority of scientific research in China at that time was concentrated in the Academy of Sciences. In 1953, the expenditure of the Academy of Sciences was 59.79 percent of the total national scientific research expenditure. In the early stage of the national construction, a number of urgent tasks including antigerm warfare, antibiotics development, nodular cast iron technology, and investigation of the source of locust in nine eastern provinces in China were all conducted mostly by the Academy of Sciences and encouraging results were obtained. The establishment of the academic departments in the Academy of Sciences and the 12-year national science and technology plan centered on the academy having had extremely important effects on the promotion of science and technology in China. In the 1905's, research organizations in industrial and defense departments were gradually established and research in institutes of higher learning enjoyed relatively great development. But some of the vital and pivotal problems of an integrated or pioneer nature were still shouldered by the Academy of Sciences, examples are key elements, material, measurement technique and basic theoretical studies in the development of the atomic and hydrogen bombs, the development of artificial satellites, and the separation of Baotou rare-earth mineral Panzhihua vanadium, titanium and iron ore. To fill up voids in China, the Academy of Sciences has also developed transistors, accelerators, electronic computers and later lasers, optical fibers and sinar devices. Large-scale general surveys were also organized by the Academy of Sciences, including surveys of Qinghai-Tibet plateau, loessial plateau, Xinjiang, Heilongjiang river valley, south China tropical and subtropical zones, desert, glacier, tundra, salt lake and ocean, and the compilation of fauna, flora, and other maps and charts. This provided scientific

basis for the rational development and integrated utilization of China's natural resources.

The scientific research system in China, including the system of the Academy of Sciences, could indeed use some improvement and perfection. But the "Great Cultural Revolution" severely interfered and disrupted the improvement of the research system, more than 60 percent of the research organization under the Academy of Sciences was handed over to defense and industrial departments and local areas, and the academy was left with only the research institutes in basic sciences such as mathematics and astronomy and a few technological sciences. The system was in shambles. The research organizations transferred out of the academy could not fully function and some could not even conduct normal scientific research. For example, after the Wuhan Institute of Aquatic Biology was turned over to the local area, its activity was limited to Hubei Province. After the Institute of Physiology was turned over to Shanghai Municipality, it was very difficult for the institute to conduct research on the physiology of plateau regions. Some institutes were turned over to defense departments but their scope of study had originally not been limited to military subjects. Because of these reasons, these institutes had to return to the Academy of Sciences one after another after the fall of the "gang of four." In the spirit of learning from the previous experience, it is beneficial to review this part of history today.

Judging from the experience of the last 31 years, the Academy of Sciences has played the role of a general center for natural science research in China and there is the need for it to continue this role in the future because of the following reasons:

1. Science and technology standards in China are underdeveloped and there are not many trained personnel. In order to satisfy the needs of national construction and catch up with the pace of international science and technology development, it is necessary to concentrate the limited manpower toward conducting specialized research.

2. Today because of our limited national resources, it is impossible for us to install many sets of large and expensive equipment. Only one set of equipment can be installed in a research center to be used by all the relevant units in China.

3. Many major scientific and technological problems in the economic construction and defense construction are of a general nature and require the cooperation of many scientific fields and military services.

4. New fields in science and technology continue to emerge on the international scene. In order to develop new fields in science and technology, it is necessary to concentrate a group of high caliber trained personnel and it is also necessary to accumulate the results of basic research.

5. The nation needs an academic organization for domestic and international academic exchange.

6. The nation needs an organization that can provide consultation and scientific verification of important state policies and can play the role of a science and technology staff department for the party and the government. There is also the need for an authoritative academic appraisal organization.

The Academy of Sciences is not only a general research center but is also the nation's highest academic organization in natural sciences. This was stipulated in the Constitution and the organization act of the State Council approved in the First National People's Congress.

The status of the highest academic organization is not in its administrative power but in its guiding and leading role in academics. The reason that the Academy of Sciences is the highest academic organization in the nation is because it has the following qualifications.

1. Members of the scientific council of the Academy of Sciences represent the most outstanding scientists of China. The council consists of not only scientists from research institutes in the academy but also scientists from all over China. In the past, less than 40 percent of the council members were scientists from the academy-operated research institutes and more than 60 percent were scientists from departments and units outside the academy. The recently expanded scientific council maintains more or less the same ratio. It is through the organization of the academic departments in the Academy of Sciences that these council members play their leading role in various scientific fields.

2. The development of science and technology in China is advanced through the high quality scientific research conducted at research institutes of the Academy of Sciences together with the contribution of other branches.

3. By organizing various academic activities, the Academy of Sciences promotes the connection and exchange of various branches, analyzes the trend of development of scientific fields in China and abroad, and explores the direction for academic activities.

In view of the reasons given above, it is appropriate for China to combine its highest national academic leading organization with the actual implementation of scientific research.

Emphasize Fundamental Research and Emphasize Improvement To Serve the National Economic and Defense Construction

To study China's scientific research system, we must begin with the actual situation in China. China has a large population and a weak economic force. In terms of science and technology, China on the whole is relatively underdeveloped but we have already established a science and technology base that has a good foundation and is relatively complete in terms of scientific fields. We can rely mostly on our own power and independently solve a series of scientific and technological problems in our national construction and we can fairly quickly catch up with the pace of international progress in science

and technology and develop new technological fields. It is dangerous to overestimate our ability but it is also improper to underestimate our ability.

Because our scientific and technological standards are relatively low, we need to learn and introduce advanced foreign technology. But we cannot rely completely on foreign nations to solve the complex economic and defense problems of a large country like ours, we need to have our own scientific research. In view of the situation in China, the technological level and economic development cannot be improved without applied research and the backward situation in applied research and technological development cannot be improved without a reserve of basic research to explore and pace the way. As a unit exclusively engaged in scientific research, the Academy of Sciences has assumed both responsibilities in the past and it now seems that there is no need for change. Of course, the Academy of Sciences is not directly involved in teaching and and production assignments, and should do more fundamental and improvement work both in basic research and in applied research. This is because:

1. Practical experience of our own and other countries has shown that, without the backing of certain theoretical sciences, fundamental advance and innovation in technology are impossible. Therefore, fundamental research is receiving more and more attention from governments and the science and technology profession. In many industrially developed nations, the expenditure on basic research is approximately 15 to 20 percent of the nation's total scientific research expenditure. Since the 1970's, Japan, considered by others as a country that only stresses technological research, has consistently invested more than 12 percent of its scientific research expenditure on fundamental research, the percentage was further increased to 16.2 in 1979. In China, on the other hand, the fundamental research expenditure is estimated to be only 3 to 5 percent of the total national expenditure on scientific research. Although there was some recovery of fundamental research at the Academy of Sciences after the fall of the "gang of four," only 5 to 10 percent of all its scientific research today is fundamental research. There are three reasons why the fundamental research was not developed more quickly. First, people engaged in fundamental research must have a certain aptitude in fundamental theory but many people were delayed by the 10-year turmoil and it has been difficult to build up this force quickly. Second, many researchers have spent a long time doing development research and cannot switch over right away. Third, because even today fundamental research is constantly criticized and blamed by various people, such as "too much fundamental research," "unpractical" and "we should first and foremost develop technological research," and researchers engaged in basic research cannot help but feel the pressure. Actually basic research is not so esoteric as some people have imagined and it is not always far removed from production. For example, research projects such as "toad without a maternal grandfather" conducted by the famous Chinese experimental biologist Zhu Xi [2612 3156] appear to be totally meaningless in terms of production, but using frog, fish and silkworm as subjects for parthenogenic development research, Zhu Xi made important theoretical and experimental contributions to the development of biology which were later applied to actual production. Zhu's analysis of the ookineisis rhythm in his earlier research successfully laid the theoretical foundation for the subsequent artificial cultivation of eri-silkworm. The artificial

synthesis of insulin is not only theoretically significant, but, because of the need for synthesis, it has also promoted the production of many other biochemical reagents and directly promoted later research in polypetide compounds and has made theoretical and practical contributions of international standards. The study of elemental organic chemistry led to a series of fluoride compounds and a fluoride chemistry industry emerged from it. The long-term study of the growth of fish in Chang Jiang has provided a scientific basis for the question of whether Gezhou Dam affects the hatching of migratory fish. There are many more examples like these.

2. Because of negligence on fundamental research for many years, China has suffered greatly. China and Japan began their respective research on semiconductors at about the same time and China succeeded in the experimental production of a transistorized computer before Japan did, and China successfully developed a laser less than 1 year after the first laser came on the international scene. Today, China has substantial production in its semiconductor industry, computer industry and laser industry and has tens of thousands of production workers in these industries, but we have fallen far behind international standards in these areas. The reasons are insufficient fundamental research on key problems and weak applied research.

3. There should be rational division of work and collaboration between the five branches of China's science and technology ranks and unnecessary repetitions should be avoided. Today a scientific force 10 times that of the Academy of Sciences is working in various industrial departments and local research institutes to solve applied and developmental research problems to serve immediate, short-term and medium-term production assignments. In terms of the national science research layout, more work on systematic basic research and medium-term and long-term applied research, development of new theories and new technologies and a more active effort to build up the nation's scientific reserve cannot only avoid repetition and confusion but are also beneficial and necessary for the overall development of science and technology in China. The research institutes of many industrial departments are making precisely the same requests to the Academy of Sciences. As scientific research develops in industrial, defense and local departments, these departments can also carry out some fundamental research within their ability and at the same time they can still submit some subjects of fundamental investigation to the Academy of Sciences and institutes of higher learning to improve mutual connection and collaboration.

Based on its nature and mission, the Academy of Sciences has determined its direction of effort: emphasizing fundamental research and emphasizing improvement to serve the national economy and defense construction, known as the "two emphases, two services" for short. As stated above, this policy is a correct one. It is precisely through the two emphases, the Academy of Sciences can provide better the two services. The "two emphases" are prerequisites for better "two services," and the latter relies on the further promotion of the former. Judging from the work done by the Academy of Sciences in many previous years, the method of combining scientific research development with solving practical problems in national construction is an effective method.

Many scientists have repeatedly discussed the specifics of this policy, we now summarize them as follows:

1. The Academy of Sciences engages mainly in the research of fundamental sciences and some technological sciences. In terms of research work, the Academy of Sciences mainly assumes fundamental research and applied research (including applied fundamental research and technological research) assignments and also assumes some development work. In the entire research field, fundamental work, i.e., fundamental research and applied fundamental research should be strengthened.

The emphases in fundamental sciences are 1 academic fields with strong leaders and high quality results and international influence such as biochemistry, neurophysiology, palaeontology, natural organic compound studies and some branches in theoretical physics and mathematics; 2 fields closely related to technological sciences and production technology such as solid state physics, high polymer chemistry, elemental organic chemistry, geotectonics and sedimentation, computational mathematics, and photosynthesis; and 3 new starts and new fields in science such as molecular biology and structural chemistry. In the meantime, there should be active support of interactions between sciences and particularly introducing mathematical and physical theories into various fields.

According to the situation in China, we should also pay special attention to the development of biology and earth science which are the foundation of agriculture, energy resources development and medicine and health.

In the area of technological science, we should strengthen scientific disciplines closely related to energy, material, and environment, make a major effort in new technology development and build a close cooperation with production departments.

2. Actively participate in solving major interdisciplinary scientific and technological problems in national economy and defense construction. Examples are investigation and experimentation in agricultural modernization, energy related scientific and technological research, comprehensive survey of resources and the associated scientific technique, research of new metallic material for the modernization of agriculture, industry and defense, inorganic nonmetallic material and organic material research, research in medicine, biology and earth science, research of population control and population quality, and providing a scientific basis for forecasting natural disaster and man-made hazards.

3. The Academy of Sciences should fully develop the role of scientists and play an advising and consulting role for major policies on national construction based on results from the laboratory and data of comprehensive studies. In the past, scientists of the Academy of Sciences have made important suggestions regarding the integrated utilization of symbiotic mines unique in China and the comprehensive management of Huang He, Huai He and Hai He. In recent years, important opinions have been provided by the Academy of Sciences regarding agricultural development policy, ecological balance,

management policy of the northwest plateau and energy policies. Effort in this area should be developed further in the future.

In the meantime, the Academy of Sciences is carrying out research in mathematics, system science, ecology, environmental science, comprehensive survey, and psychology and will be making contributions to the development of management science and the modernization of national economic management.

4. The Academy of Sciences should strengthen the cultivation of scientific and technological cadres, continuously improve the quality of research and technical staff and deliver trained scientific and technological personnel to other branches. One of the fundamental missions of the Academy of Sciences is to produce trained personnel and it has trained in the past a large number of cadres specialized in new theory and new technology (such as semiconductor, computer, laser and automation) for many departments and units. It has also provided cadres to relevant departments. In the future, large and sophisticated research facilities at the Academy of Sciences should be fully used to attract technical personnel from other units to work together and scientific and technological personnel with independent research ability should be delivered to other units more systematically.

As the entire party and the entire population gradually improve their understanding of the importance of science and technology, as demands on science and technology gradually increase in the national economic readjustment and as the nature, mission and direction of the Academy of Sciences become more definitive, it is entirely possible for the Academy of Sciences to play its deserved and important role in China's scientific research structure. The solidarity and collaboration of the various branches of science and technology in China should also become more and more heightened.

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ACADEMY OF SCIENCES ESTABLISHES POLICY FOR FUNDING ASSISTANCE

Beijing GUANGMING RIBAO in Chinese 28 Mar 82 p 2

[Article: "Procedures of Implementation of Provisional Regulations Governing the Science Funds of the Chinese Academy of Sciences, Passed at the First Meeting of the Science Funds Committee of the Chinese Academy of Sciences, 2 March 1982"]

[Text] The following procedures are specially established on the basis of the Provisional Regulations Governing the Science Funds of the Chinese Academy of Sciences (hereafter referred to as "Regulations"), in order to properly use and manage the science funds of the Chinese Academy of Sciences and to advance the development of scientific technology.

Application for Funding Assistance and Review of Projects and Topics

1. Applications for funding assistance from the science funds for research projects and topics may be submitted at any time. Reviews are conducted according to set schedule. Projects and topics meeting the funding guidelines under the "Regulations," for which specific research capabilities are available but funds are needed for implementation, may be submitted for funding to the Science Funds Committee (hereafter referred to as the committee) of the Chinese Academy of Sciences. Generally, about 6 months are required from the time an application is received by the committee to the time the committee completes its evaluation. Reviews are conducted by the committee in April and October.

2. An application for science funds must be filled out by the researcher in accordance with the format of the science funds application form of the Chinese Academy of Sciences and item 15 of the "Regulations." After review by the research committee of the researcher's unit (or its department in charge of scientific research) and a decision by the unit's leadership as to whether or not to support the research, and his rendering of an opinion as to whether or not certain basic work conditions can be guaranteed, and if all conditions are favorable, the application is then submitted to the Science Funds Committee. Applications should be submitted on No 16 paper and in 10 copies.

3. Evaluation and approval by professionals with interests along similar lines to projects and topics for which funding is requested. After proposals

for research projects and topics are received by the Science Funds Committee, they are usually transmitted separately to related academic-science funds groups for evaluation. Based on opinions as to evalation, feasibility, and overall balance, the various academic science funds groups make a selection of projects and topics for funding. For projects and topics below 100,000 yuan, approval is given directly by the academic science funds groups, and these are reported to the Science Funds Committee for its record. Projects and topics [requiring] over 100,000 yuan are reported back to the Science Funds Committee for approval before transmittal back to the applicants. Because of limitations in the total funds available, projects and topics which have successfully passed an evaluation but do not get final approval are listed as reserve projects and will be given priority consideration in the next go-round.

4. For the benefit of discovery, cultivation of personnel, and development of scientific work in the far border regions, priority consideration should be given, all things being equal, to young scientific and technical workers and those in the far border regions. At the same time, scientific and technical workers in advanced departments, advanced regions, and advanced units are encouraged to cooperate in the research in order to fully develop our scientific and technical potential, advance scientific and technical development, and better serve the national economy and national defense.

5. At the time the projects and topics are approved for funding, the Science Funds Committee and the academic science funds groups will notify the persons responsible for the projects and topics and the units where they are located, and the responsible departments will be informed by copies of the notifications. The involved units and departments should integrate the funded projects and topics into their research plans, strengthen their direction and supervisory inspection, provide full support in terms of personnel and materials, and organize coordination by the administrative sections. The persons responsible for the projects should respect the direction and supervision of their own units.

6. Applications for science funds must be for newly developed research projects and topics. If the research content and adopted research and technical approaches duplicate work by other units in the country, or if research expenses have been arranged through some other means, funding will not be provided under the science funds.

Management of Funds

7. In principle, funds for the support of a project or topic are determined all at once and are allocated in stages. Any surplus is kept for future use, and overruns are not covered. Based on actual conditions, budget plans may be appropriately adjusted on a yearly basis. Surplus funds at the end of the year may be transferred for use the following year.

8. After receiving notification of approval of research projects and topics, the applicants should proceed with their work in accordance with the approved contents. If an applicant does not agree with the approved contents, he should report this to the Science Funds Committee within 1 month for further study and disposition.

9. Funds for the support of projects and topics are transmitted to the units where the persons responsible for the projects and topics are located. The finance departments in the units will be responsible for management of the funds, setting up separate budgets and separate accounting for the funds, which are to be used specifically for the intended uses. Within the guidelines of the finance system, persons responsible for the projects have the authority to allocate the use of the funds.

10. The use of the funds for the support of projects and tasks must be determined very carefully to achieve conservation. Expenditures are limited to those specified under Item 13 of the "Regulations." The following expenditures cannot be included:

(1) Building costs, office maintenance costs, and public affairs expenses.

(2) Wages, wage subsidies, and labor and insurance welfare expenses.

(3) The cost of joint-use instruments and equipment where they are not in use by the funded projects and topics over 60 percent of the time.

(4) Instruments, equipment, and materials already available prior to the application.

11. Accounting reports should be compiled yearly on expenses charged to the science funds and sent to the Science Funds Committee on 15 January following the end of the year. A final total accounting for each research project and topic should be compiled after completion of the research work, should be submitted to Science Funds Committee for verification. Leftover funds generally can be kept in the unit to be used as research funds. Priority use (generally not less than 50 percent) should be for research projects conducted by the person responsible for the project supported by the science funds. If the leftover funds are relatively large, the Science Funds Committee has the authority to take back a portion for the support of other projects.

Supply of Equipment and Materials

12. Equipment and materials needed for the project and topic funded by the science funds will be requested through normal channels by the unit where the researcher works. Separate accounting records should be established for such equipment and materials. The equipment and materials should be properly managed according to the management system for goods and materials.

13. When the research work for the funded project and topic is totally complete, fixed property and leftover equipment and materials should be assigned values and kept in the unit for use, without compensation, and a record of this is to be reported to the Science Funds Committee for its files. If, for any reason, the funded project and topic are canceled midway or the funding is discontinued, unused funds and equipment and materials should be withdrawn and clearly returned to the Science Funds Committee.

Research Results and Work Report

14. After the research work for the science funds-supported project and topic is completed, conclusions should be conscientiously prepared, complete data, drawings, and materials organized, and a research report and academic paper written. These should be submitted to the academic science funds group, the Science Funds Committee, and the management department.

15. The organizational unit or the science organization (such as the science committee) of its upper management department is responsible for evaluating the research results of the funded project and topic. Results of this evaluation are to be reported to the academic science funds group, Science Funds Committee, and the management department. The Science Funds Committee and the science funds group will select results of important significance, organize their evaluation, compile on a regular schedule the results of important scientific significance or practical value, and recommend them to the relevant departments.

16. The persons responsible for the projects and topics should periodically submit work reports to the concerned academic science funds group and the Science Funds Committee. Progress reports should be submitted every 6 months. Annual work reports should be submitted at the end of the year. Final work summary reports should be submitted when research projects and topics have been completed.

17. Research results (including treatises, reports, etc.) should be published as quickly as possible. The publication should clearly state that it covers a project funded by science funds of the Chinese Academy of Sciences.

18. Applications for reward, transfer of possession, and patent for the results are processed according to appropriate state regulations.

Other Points

19. Fund allocation requests, research reports (semiannual, annual, and final), annual accounting reports, final accounting, result registration forms, and various formats and requirements of forms and reports are transmitted along with notifications of approval of projects and topics.

20. These procedures are effective on the date of publication. They will be revised and amended as experiences of their implementation are summarized.

Science Funds Committee, Chinese Academy of Sciences: Key Principles of Support for Project and Subject Applications for Science Funds (2 March 1982)

Science funds are used mainly to support our country's basic type of work in basic and applied research in natural sciences. Emphasis will be on the support of subjects with important scientific significance, with independent academic understanding, and where results are anticipated on a short-range basis. Support will also be given to fill gaps in important subjects, to strengthen weaknesses in branch subjects, and to [contribute to] the growth of fringe subjects. Priority support is given to the following types of topics:

1. Basic research topics closely related to the modernization of socialism in our country.

2. Basic research topics in various subjects designated for important development in the near term.

3. Topics beneficial to the cross integration of various sciences and various technologies and to the development of fringe subjects.

4. Topics beneficial to the promotion and application of new technology.

5. Topics beneficial to the promotion of cooperation between various units and to the full utilization of existing facilities.

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TAILORING S&T MODERNIZATION TO LOCAL CONDITIONS

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese, Vol 4 No 1, Feb 82 pp 30-38

[Article by Li Chang [2621 2490]: "Developing Science and Technology in a Big Way Is an Urgent Task of Building a Modern and Strong Socialist Nation*"]

[Text] Since liberation, China's science has developed greatly. The Academia Sinica and such agencies during the period of the Kuomintang government had only 200-odd researchers. Now, the Chinese Academy of Sciences alone has 118 agencies with a staff of more than 76,000 workers, and among them, more than 30,000 are scientific researchers. In the whole nation, there are 330,000 people specifically engaged in research. This is not a small force and it shows that our nation's scientific research has established a preliminary scale.

But in retrospect of the work during these years, we believe our nation's science and technology as a productive force has not served sufficiently to promote the national economy. Our understanding of the importance of science and technology is also very deficient. We have not elevated science and technology to a position that they should enjoy. Aimed at this situation, Comrade (Hu) Yaobang mentioned three aspects: First, we must improve the whole party's and the whole people's understanding of the importance of science and technology. Second, the Central Committee must establish correct guiding principles and policies for science and technology. Third, scientific and technical work must make major contributions. Only in this way can the people's understanding of the importance of science and technology be improved and the speed of development of our nation's science and technology be quickened. Below, I shall emphasize the problem of understanding the importance of science and technology and the question concerning the guiding principles to develop science and technology.

(I) The Problem of Understanding the Importance of Science and Technology

The Central Committee places a lot of emphasis on science and technology. In 1964, Premier Zhou proposed the question of modernization of science and

*This is an excerpt of the speech given by Comrade Li Chang at the Chinese Communist Central Party School on 10 April 1981.

technology at the Third National People's Congress. But the "Cultural Revolution" interrupted the course of realization. Later, Premier Zhou pointed out this problem again in 1975. In 1975, when Comrade (Deng) Xiaoping managed the affairs of the Central Committee, he again emphasized scientific and technical work. In July 1975, I followed Comrade Yaobang to work at the Chinese Academy of Sciences. Not long afterward, Comrade Yaobang took charge and Comrade (Hu) Qiaomu, et al, participated in drafting a "general report and guideline." When the State Council discussed the "general report and guideline," Comrade Xiaoping emphasized that modernization of science and technology serves a very important function in the four modernizations, and this link must be grasped. Of course, because of the "opposition to the rightist reverse the verdict movement," the course of realizing the four modernizations was interrupted. After crushing the "gang of four," the Central Committee was clearer on this point. On 30 May 1977, the Politburo of the Central Committee specifically discussed the problem of science and technology, and decided to hold a national science conference. In March 1978, Comrade Xiaoping further pointed out clearly to the National Science Conference that the key to the four modernizations is the modernization of science and technology. hhis has elevated science and technology to a very high level. But, even though the responsible comrades of the Central Committee have again and again emphasized the importance of science and technology, some of our comrades still do not have a sufficient understanding of their importance. Even after they have suffered, their understanding still did not deepen. What is the cause? Of course there is the "leftist" influence here. But, after correcting "leftist" mistakes, will the understanding be sufficient? Not necessarily so. I feel that there are still profound historical and social causes and there is the factor of understanding. Without seeking the root of these aspects, this problem is still not easy to solve.

1. Historical Reasons

Modern science and technology have developed along with the development of Western capitalist society. They have served greatly to develop the capitalist economy and society. But, because China remained a semifeudal and semicolonial society before liberation, we were not familiar enough with the development of modern science and technology and our understanding was more abstract. We did not feel their great impact directly and our understanding of course could not progress.

Everyone knows the milestone of modern science was Newtonian mechanics and calculus. The formation of modernization was conditioned by the emergence of the capitalist class. It was born in Europe because Europe was the first to change from a feudal society to a capitalist society. Although Europe's feudal society, and the production relations of feudalism were truly established only as late as the 9th to the 11th century, but the emergence of capitalism was relatively early. At the time, the church ruled over the spiritual kingdom of Europe, and at the same time, the church occupied a lot of land of the nations adhering to the faith. Worldly leaders and kings and dukes occupied castles and manors. The world was divided and strongmen ruled independently. Under this situation, commercial production and exchange began to develop slowly. By the 11th century, especially by the 12th century,

European cities and towns appeared on a widespread basis. The Crusades and the discovery of America prompted the rapid development of European industry and commerce. In these newly emerged cities, handicraftsmen, merchants and even apprentices and assistant workers formed the modern capitalist class and the proletariat, and at the same time, intellectuals emerged. Later, the university emerged. Europe was different from our nation. Feudal rule centered in the villages while newly emerged cities were places of concentration of the capitalist class. And it was these cities that became the arena which produced modern science. On the one hand, prosperity of the urban economy created the need for science, and at the same time, the democratic revolution of the European capitalist class was also centered in the cities, and science became the sharp spiritual weapon of the capitalist class opposing feudalism and the church, thus the development of science was pushed forward. On the other hand, the development of production was also helped by science and technology. The steam locomotive was invented in the 18th century, followed by ships, trains, the telegraph, and also what the Chinese called the foreigner's armored soldiers, battleships and artillery. This greatly increased the productive strength of the capitalist society, and thus capitalism was able to conquer large colonies, semicolonies and satellite nations.

By the second half of the 19th century, the function of science became more visible. Science could march ahead of production, and such a process began--first science, then new technology, and then industry. For example, the two major industries of the second half of the 19th century were both begun by scientific research. One was the electrical industry. First there were the principles of electromagnetism, and then these principles generated electrical technologies, and then an entire electrical industry emerged. The other was the chemical industry. Similarly, first there was modern chemistry which developed chemical analysis and synthetic technologies and it finally build a chemical industry.

Marx and Engels made such a statement in the "Communist Manifesto": "The productive force created by the capitalist class during its less than a century of capitalist rule is much greater than all of the productive forces created during all past periods." Then, how did the capitalist class develop its productive force so greatly? Marx said: "Unless it continues to revolutionize production tools, production relations and all social relations, it will not survive." In such fierce competition in the capitalist class, science and technology continued to change the production tools, and science and technology became the tool with which the capitalist class to become rich, and they served as its meritorious workers and founding fathers. We can see that in the Western capitalist world, scientists, investors and professors are widely respected and praised in the society, and they have become society's knights, heroes, virtuous persons and saints. Even today, Great Britain still bestows the honorary title of "sir" upon scientists who have made contributions.

Here is some information on the function of science and technology in increasing material wealth. In the five nations of Great Britain, the United States, France, Germany and Japan, the annual average per capita income in 1850 calculated in constant 1926 prices was $235. By 1950, after 100 years, the per

capita average was $861. By 1973, before the petroleum crisis, the per capita income was $4,606. From 1850 to 1973, a period of more than 120 years, average per capita income increased from $235 to $4,606, and so much wealth was created. Let us talk about another concept. From 1860 to 1950, the annual average personal income in Western Europe increased at a rate of 1 percent. From 1950 to 1970, during the 20 years after the war when capitalism developed the fastest, the rate was 4.5 percent. Therefore, the function of science and technology is very well understood by the capitalist class and it has long been accepted by society.

In contrast, the situation in China during this period was vastly different. During the Sung and the Yuan Dynasties, we were still leading in science and technology, but after the 16th century, we fell behind. Why was this so? In 220 B.C. the Qin and Han Dynasties began establishing a unified feudal empire. For more than 2,000 years, there were 3 divisions (4 divisions if we include the chaos of the warlords during the beginning years of the Nationalist government). The duration of such divisions was all very short. Most of the time, China was a unified feudal empire. The economic foundation of this large unified empire was the natural economy of the small farmers. The emperor relied on feudal exploitation and he did not want to develop a commercial economy. All imperial dynasties emphasized agriculture and suppressed commerce. Industry frequently was established by the government and products were not supplied to the civilian population. The father of the author Cao Xuejin of "The Dream of the Red Chamber," Cao Fu, served as the Jiangning textile manufacturer, an industry of the emperor. Our nation has always despised technology and regarded technology as "insignificant skills." Especially during the late period of the feudal society (after the Ming Dynasty), literary inquisition was rampant and people's thoughts were imprisoned. To foreign nations, China was basically closed, and the economy and culture did not develop. Although large cities emerged in our nation early, like the city of Hangzhou (then called Linan) during the Southern Sung Dynasty which had already become a large city with a population of 1.2 million, China's cities were centers of feudal rule (from the emperor to the bureaucrats to the landlords). And in recent times, the cities were still centers of government of such rulers with the participation of imperialism, unlike European cities. China's democratic revolution of the capitalist class was also centered in the farm villages, unlike Europe where the cities were basically the center of such revolution. Chairman Mao created a lot for the democratic revolution. The common truths of Marxism-Leninism were combined with concrete practices of the Chinese revolution and they produced Mao Zedong Thought, and the road to victory of the Chinese revolution was found--to use the farm villages to surround the cities, and the cities were finally liberated. But objectively, some problems were created, and we were unfamiliar with recent and modern science and scientists, and our understanding of the importance of science and technology was insufficient, thus, the policies concerning scientific and technical personnel easily made "leftist" errors, and the intellectuals became the targets of reform. We did not have a history of relying on science and technology to promote the economy. We did not have a tradition of utilizing science and technology to develop the economy, therefore, although we have repeatedly said that science and technology are important, it is not easy to truly accept it. This is the historical reason.

2. Social Reasons

After liberation, our nation's society underwent a fundamental change. A socialist nation led by the party was established. And during the past 30 years, industrial and agricultural production and scientific education all developed very quickly. This is affirmative. Now, fixed assets of the system of ownership by the whole people have already reached over 40 million yuan, an increase of more than 20 times over that before liberation. But, we must realize that after liberation, our nation's major industries and scientific research mainly paralleled foreign imports or the knowledge was mostly learned. Our science was not mostly established on our industrial foundation. Our industry was not developed under our own promotion of science and technology. These two aspects are unlike those in foreign nations which have been closely combined for several hundred years. This is one aspect.

Second, in the past, our economic management system also had problems. We practice a command-type planned economy under centralized authority. For a long time, we have committed "leftist" mistakes of pursuing high accumulation, high speed, low gain and low consumption. We do not recognize production materials as commercial commodities. The scope of commodities has been drawn narrower and narrower. The regulatory function of the market has become smaller and smaller. We always fear that a commercial economy will develop. This type of economic management system of ours originated from two sources: One was based on the locality's supply system (at the time, this method served an active function). The second was learning the backward things of the Soviet Union of the 1950's. In this way, production became unified procurement and guaranteed sales. Things were done according to the directives of higher authorities. We did not care about economic gains and we did not pursue product quality. There was no competition, and the inner economy lost the motive force to utilize and promote science and technology, thus, production technology became stagnant.

The third problem among the social causes was that after reformation of the ownership system of production materials was completed, we should have centered our efforts on the development of production, but we did not do so. Actually, all of our work was centered around class struggle and political movements, and economic work was viewed only from its political aspect, and it did not reflect the basic laws of socialist economic development and it did not rely on science and technology. Scientific and technical departments did not know what demands the economy made upon science and technology, and they did not understand clearly that they should serve the economy and how they should serve the economy. In this way, it was difficult for the five major forces of our scientific research system, the science academies, the national defense industry system, the system of production departments, the universities and the local scientific research agencies to establish unified cooperation and coordination, and frequently, each carried out its own work and each was separated from the other. Science and technology could not develop and exert their strength, and this helped the growth of departmentalism and the local ownership system. The situation became even worse during the "Cultural

Revolution." Some people even said that "ever since Pangu created the heavens and earth, we planted the fields without science." Later, private ownership of knowledge was criticized, and people said "more knowledge means being more reactionary." Under this situation, how could science and technology be emphasized? This is the social reason.

3. Reasons of Understanding

Originally, natural science was a foundation of dialectic materialism. Chairman Mao also said many times, philosophy is the generalization of natural science and social science. This shows that Marxists should enrich and develop dialectical materialism from social struggle and from advances in natural science. But, because the world communist movement of the past was mainly in the stage of seizing political power and communists utilized Marxism-Leninism mainly in class struggle, consideration of natural science was scarce. In the history of the international communist movement, Engels was the one who studied natural sciences the most. He once said: "Like idealism, materialism also underwent a series of developmental stages and materialism must change its own form along with every major development in natural science." Lenin also said: "Materialism believes that the world is richer, more lively and more varied than what it appears to be, because whenever science develops one step further, a new aspect of the world will be discovered." To protect dialectic materialism, the question of the conversion of elements following the discovery of radium and electrons could not be explained by classical physics. Physics encountered a crisis, and some people seized the opportunity to advocate that "materials are destroyed." Lenin wrote "Materialism and Empiro-criticism" and summarized some of the achievements in natural sciences at the time. But Lenin's major effort was directed towards leading the Russian proletarian revolution. He did not have more time to study all the developments in natural science that had occurred before his death. And at that time, he had not seen Engles' "Dialectics of Nature" (this was discovered only after Lenin died). As we entered the period of socialist development, we should have emphasized science and technology and the use of new achievements in natural science to enrich dialectic materialism and to use dialectic materialism to guide the development of natural science. But, the Soviet Union did not handle the question of natural science well and it made mistakes, such as blindly criticizing Morgan's genetics theory, Pauling's resonance theory and cybernetics. (Lisenko) and (Leboshinskaya) whom they supported were engaged in pseudo-sciences, and they became a big joke in the world.

Because of the historical and social reasons mentioned previously, our party is unfamiliar with recent and modern natural science. Since liberation, and since the time when the socialist reform of the private ownership system of production materials was basically completed, our party has still not paid attention to using the new achievements of current natural science to enrich dialectic materialism. Chairman Mao was a great Marxist. He wrote the great works "Problems of Strategy in China's Revolutionary War," "On New Democracy" and "On Protracted War." But some of the mistakes in 1958 and especially during the "Cultural Revolution," such as the campaign and the practice of "smelting iron in a big way," could not be understood in view of the level of modern scientific knowledge. This is the first problem in understanding.

Second, we have included scientific experiment as one of the aspects of the Three Great Revolutionary Movements. This saying as seen today is also debatable. Modern science is the product of hard mental labor of scientists over a long period. It must be repeatedly and systematically observed and tested, qualitatively and quantitatively studied from many aspects, and repeatedly proven and examined before it can develop. It is not something that many people can rush over and develop a truth about. Without long periods of specialized research by scientists, there will not be any modern science. Of course, this does not mean that organized collective research under an academic leader is not needed. Neither does this mean opposing the mass line in scientific research. It is a belief that we cannot use the method of mass movement to carry out scientific research. Our cadres have had the experience of fighting to reduce rent for land and interest on loans, fighting for land reform, resisting the United States and assisting Korea, carrying out the patriotic health campaign, and they easily accept the use of the methods of mass movements in scientific research. But the results of this method are not good. For example, when the comrades of the leadership at each level engage in experimental fields for planting, strictly speaking, they are not engaged in modern scientific experiments. Where is the design of the experiment? What problems are to be tested and proven? What are the results? These are all difficult to say. "Taking food grains as the key link" and "the eight point character for agriculture" all lack precise scientific concepts. Up to what level do we consider it a "key link?" Nobody can explain it clearly, and as a result, serious problems raise in practice. Some people have made up their own saying: "When taking food grains as the key link and blindly reclaiming land, when agriculture, forestry, livestock production and sideline production use up all the land, soil erosion occurs, and drought and flooding occur frequently."

The above situation shows that we do not understand the characteristics of modern science and technology. Although the original intension of many comrades were good and they wanted to quickly push China's economy forward, but because these ideas and methods were not suited to modern science, as a result, haste made waste, and China's economic development was delayed. This situation has not been completely solved yet. Some of us do not have a high regard for experts and talented people. Some experts work at jobs they are not trained for, and they are not released even when units that can utilize them want them. Whenever someone proposes to establish a research institute, he wants 300 or 500 people. He does not understand that a research agency does not care how many hundred people it has, what matters is whether it has any high caliber scientists. Achievements cannot be made simply because there are many people.

All of these historical and social reasons and factors in understanding have caused our cadres to have an insufficient understanding of the importance of science and technology. Therefore, our task is to learn recent and modern scientific knowledge of the world well and inherit all scientific culture and spiritual wealth created by mankind. We are a socialist nation. We have this condition and we have this need. The foreign capitalist class has grasped production and exchanged it for profit.

To achieve this goal, foreign capitalists have continued to reform production relations and social relations on the one hand, and on the other hand, they have developed science and technology. Similarly, we should also pay attention to economic gain on the one hand and reform our production relations and social relations to meet the material, cultural and living needs of the people. On the other hand, we must develop science and technology, and we must study natural science well, enrich dialectic materialism and use it to guide the building of the four modernizations.

Although we are far behind foreign nations in science and technology and material production at present, and our understanding of the importance of science and technology is still not sufficient, we must not improperly belittle ourselves and we must not give up. We are the rising sun. Although we have suffered great reverses, the future is bright. We also suffered reverses in the democratic revolution. We carried out a revolution in such a large nation in the East, we took the farmers as the main body of people and the semifeudal and semicolonial production relations as the target of the revolution. Marxism-Leninism did not even tell us how to do it. We explored independently, and naturally we encountered a lot of setbacks. Chairman Mao creatively solved this problem only later. Now, the same problems are being encountered in national buildup. As long as we conscientiously summarize the experience, we will continue to advance. Today, we examine our deficient understanding of the importance of science and technology because we still have confidence to march forward.

(II) The Question of the Guiding Principles To Develop Science and Technology

To develop science and technology, cadres at each level should improve their understanding of the importance of science and technology, but there is still another important question. That is, there must be a set of correct guiding principles and policies that suit our nation's situation. If this problem is not solved, our nation's science and technology will still be unable to develop. The most outstanding aspect of this problem is the question of combining science and technology and the economy. The actual function of science and technology to promote production is also not obvious. From top to bottom, we do not feel that science and technology are a productive force. Of course we have some endeavors that have been done well. The more outstanding achievements have been the atom bomb, hydrogen bomb and satellite). In this question, the target is clearer. The National Defense Science Committee is better organized. Our Academy of Sciences has also participated and has done a lot of work. But generally speaking, some questions on the scientific and technical battlefront in the past have not been clear enough. Recently, several situations favorable to this combination have emerged:

One is that the reform of the economic system has begun to require science and technology, especially in the farm villages. We can say that now, our agricultural production has realized a major breakthrough. In the past, production relations have always walked ahead of procutive forces, "everyone was eating from the big pot," "everyone wants to work but not everyone who attends does any work." This cannot mobilize the productive enthusiasm of the

farmers. After the Third Plenum, procurement prices of agricultural products were raised, market trading in the farm villages revived, emphasis was placed on expanding the autonomy of production brigades, and measures were suited to local circumstances to engage in diversification. Especially since last year, gradual popularization of various forms of the responsibility system of specialized work contract, linking production with remuneration and contracting work to the families, contracting work to the laborers has begun. Each year, over 10 million tons of food grains are imported, enabling the farm villages to rest and build up their strength. This series of measures have caused a great change in our farm village work. The productive enthusiasm of farmers has been mobilized. Thus, the welcomed situation of farmers wanting science and technology has emerged. The enthusiasm of farmers in learning science and technology has increased. Some old ladies in Shandong even ride horse carts to learn techniques of planting cotton. A manager of a seed company in Guizhou who was a university graduate from the agricultural science academy said that whenever he goes into the villages, he is surrounded by farmers asking about this and asking about that. Whatever they said they did accordingly, and they realized bumper harvests. They happily invited us to have a feast to celebrate the harvest. When this was reported to the higher authorities, starting from the party Central Committee, everyone liked to listen to scientists. Recently, Comrade Shishan [4258 1472] of the Chinese Academy of Sciences wrote an article which said that farm village work has broken through 10 restrictions. "Taking food grains as the key link" need not be mentioned anymore. There is a researcher named Comrade Hou Xueyu [0186 1331 3558), who wrote an article in the RENMIN RIBAO and talked about the problem of feeding a population of 1 billion. He advocated macrocosmic food grains and macroagriculture. Macrocosmic food grains means that food grains should not be limited to wheat, rice, corn, but the staple must be expanded to include the eating of meat and woody plants such as chestnuts, walnuts and papayas. Macroagriculture means that besides planting, there should also be agriculture, forestry, livestock production, sideline production, fishery, and insect culture such as sericulture, beekeeping and microorganic cultures, etc. The comrades of the Central Committee liked the articles written by Comrades Shi and Hou. Recently, the Central Committee made a resolution concerning agriculture. It emphasized suiting measures to local circumstances, diversification, fine plowing and fine planting, and it included seven opinions by scientists. The Central Committee believed that they should be listened to and followed. Now, agricultural policies have begun to progress on course. This is a new situation.

Another situation is the establishment of the new 5-year plan. In the past, we seldom considered the factors of science and technology. We only drew up economic plans and we did not mention science and technology, and we did not mention the needs of social development (what are the needs for food, for clothing, for housing, for daily commodities, for transportation during this period, how many schools, hospitals, movie houses, broadcasting stations, etc., must be developed). Therefore, last year, in drawing up the "5-year plan" and the "10-year forecasts," Comrade Xiaoping, based on the experience of foreign nations, proposed that our plans should be a three-in-one development of science and technology, economy, and society. One of my feelings is that we can start out from the needs of social development to determine the economic

plan accordingly to guarantee the realization of social development plans. Then, we can establish plans for science and technology according to the economic plan to guarantee its realization. There is another way, which is to begin from science and technology. First we should find out which natural productive forces can be developed by science and technology in 10 years or 20 years (such as petroleum, coal, hydraulic power, land resources) and to what degree, then we can determine the economic plan and finally draw up a plan for social development. The Soviet Union followed the latter way. If we use both of these methods and combine them together, I believe this will be a major breakthrough in our planning work. Including our plans for science and technology in the entire plan by these methods would fundamentally guarantee the development of the function of science and technology and this will be a big step forward.

Recently, the Central Committee proposed further that science and technology, the economy and society must develop in a coordinated manner. This is the fundamental guiding principle in developing our nation's science and technology. The proposal of this guiding principle means that our nation's science and technology has entered a new era. If we can conscientiously implement this guiding principle, our science and technology will change fundamentally. Our economic development and social development will also undergo a great change. We must have a sufficient understanding of the important significance of this guiding principle. Not long ago, the Central Committee Secretariat heard the reports by the Chinese Academy of Sciences and the State Scientific and Technological Commission and approved the two "general report and guidelines" they proposed. The Central Committee Secretariat also approved the basic guiding principle for the development of science and technology proposed by the State Scientific and Technological Commission: First, science and technology and the economy and society should develop in a coordinated manner, and the promotion of economic development should be the foremost task. Second, emphasis should be on strengthening the study of production technology, technologies should be accurately selected, and a rational technological structure should be formed. Third, development and popularization of the technological processes in factories and mines should be strengthened. Fourth, basic research must also develop gradually on the basis of maintaining a stable foundation. Fifth, learning, digestion and absorption of foreign scientific and technological achievements should be important ways to develop our nation's science and technology. According to the guiding principles approved by the Central Committee, I feel that in execution, attention should be paid to the following problems:

First, on the entire battlefront of science and technology, we must pay special attention not to spend all our efforts in pioneering sciences. We must pay attention to those broad, abundant and frequently encountered problems and those projects that truly have economic benefits. We must not be in a situation where we can develop advanced alloys but we cannot guarantee the quality of ordinary steel materials. Scientific research work must be practical and must truly pay attention to economic gain to serve the needs of developing the economy, to satisfy the needs of the material and cultural life of the people. We must exert efforts to solve the problems in clothing, food, housing,

daily commodities, transportation, in the development of education, culture, sanitation, in resisting natural disasters and in protecting the society and national security.

Second, we must pay attention to selecting the right technological structure, and establish a technological system that suits our nation's situation. If we do not start out from our nation's situation but transplant foreign practices, they will not work. Take agricultural modernization as an example, some comrades who went to the United States to visit have returned to advocate ways of agricultural modernization according to the situation in the United States. First, they advocate mechanization and mechanization of all operations. The machinery and equipment of one farmer in the United States costs $40,000 to $50,000, and on the average, they outnumber workers. Second, they advocate specialization, dividing the fields into corn belts and wheat belts. In this way, airplanes can be used to sow and to spray farm chemicals. Third, they advocate socialization. There are transportation companies which will respond after one phone call. When a farmer wants to spray insecticides, one phone call will be sufficient to obtain an airplane to spray farm chemicals for you. Thus, some of our comrades said, if China wants to realize agricultural modernization, it must first develop mechanization. Actually, this view is not entirely correct. This is because there are different types of agricultural modernization in the world. They can generally be divided into three types. One is the type used in nations which are relatively developed industrially and which have a lot of land but few people and insufficient labor forces, such as the United States, the Soviet Union, and Australia.

These nations mainly rely on agricultural mechanization to increase the labor production rate. The second type is used by nations with more people and less land, such as Japan, which emphasizes the use of biochemical measures first, i.e., improving seeds and applying chemical fertilizers with the goal of increasing unit yield. The third type is found in nations with insufficient cultivated land and labor forces, such as Western European nations like France and West Germany which have a better industrial foundation. Their way is to develop machinery technology and biochemical techniques simultaneously. The situation in each nation is different and the methods used are different. What about us? The main portion of our agriculture is in the eastern part and the central part. The population here is very dense. There is a lot of labor force, and basically our agriculture belongs to the Japanese type. We just said that mechanization requires a lot of investment. The money relies mainly on personal savings of farmers. Mechanized agriculture is basically petroleum-based agriculture. We cannot afford to use too much oil. Therefore, most of the regions in China cannot emphasize mechanization as the main effort, thus it is better to take biochemical measures as the main effort. Of course, this does not mean that our agriculture does not need mechanization, it means that our agricultural machinery must also be suited to local circumstances. The Chinese Academy of Sciences and the Heilongjiang Provincial Committee jointly established a comprehensive experimental base for agricultural modernization in Hailun County. Here, a definite number of combines were needed. After wheat and beans ripened, combines must be used to harvest them, otherwise, those left on the ground could not be harvested. The

second type of equipment is hand tractors. Because hand tractors have many uses, they can be used in large field operations, they can be used for transportation in the fields, and they can be used for operations in the drying yards. The type of large American machinery that is highly efficient and can complete such a little bit of farm work in no time, is not used many times a year, thus such machinery is not worth it. In the United States, corn fields cover several states, the maturation periods in the north and in the south are different, and large machines can traverse from south to north continuously and they have more uses. Our nation is spotted with small fields. We plant flowers, till and plant crops together, and all kinds of crops are planted together. Those large machines cannot do the job. In industry, our nation also has its characteristics. Our nation has a large labor force, wages are low, and there are many unemployed youths. We must develop more labor intensive industries. Therefore, in this sense, the technological structure must be selected well.

Third, the understanding of modernization of science must be accurate. Modernization of science means that we should research those problems that modern science has not solved. Theoretical research should be creative. It must have academic value. Completely repeating what others have done is meaningless. We can select large or small subjects, and achievements can be made at different times. But, it will not work if you engage in theoretical research without creativity. First, the subject must be modernized. In experimental sciences, modernization means that we should have modern experimental means, otherwise it is very difficult to develop modern experimental science. For example, in high energy physics, if there is no high energy accelerator, you will not be able to perform experiments. And if you want to study it, you will have to go to foreign nations to perform the experiments. Viewing the present situation, our academic standard is not high in experimental sciences but in those theoretical or regional sciences, such as mathematics, theoretical physics, biochemistry, geology and biology. Some of them have reached the world level, like artificial synthesis of insulin. We also possess some achievements which are of world standard in regional sciences, such as geological mechanics of Li Xiguang [3621 0934 0342] which foresaw our nation's eastern oilfields, geochemistry which explained the cause and analyzed the characteristics of the Baotou Iron Mines, where foreigners cannot catch up with us. Again for example, foreigners say that there are only 80 species. Our survey listed more than 400 species. This is first hand information and nobody is as good as us. The Himalayas affect the weather of the whole of Asia and even the world. In the study of the Himalayas and the Qinghai-Xizang Plateau, we are the masters, and our achievements are authoritative.

What then is modernization of technology? It is nothing else but the technology which can realize the greatest economic gain. It does not have to be a pioneer technology and the most automated. When the conditions are not present, the most advanced things may not produce the best economic result. For example, our nation leads in the use of marsh gas as a source of energy in farm villages. In the whole world, there are two nations that are carrying out such projects in a big way, one is us, and the other is India. It is internationally recognized that India is behind us. India is developing marsh

gas mainly by relying on foreign cooperation. The degree of mechanization is very high. The price is very high and a lot of investment is required. We do not need that much investment. Our projects easily produce results and they are commonplace. Therefore, technological modernization must be suited to our nation's situation and it must consider economic gain. It must be based on our nation's mineral resources, land resources, biological resources, and manpower resources to establish our own technological system.

Fourth, to strengthen technological development of factories and mines, there is a fundamental concept that must be changed. During the 1950's, we learned a backward concept from the Soviet Union. We believed that the technicians in the science office of factories belonged to nonproductive personnel. The total number of nonproductive personnel in a factory cannot surpass 18 percent, and the number must be limited. This was wrong. I went to visit the Philips Company of Holland. Research on the electron microscope that they manufacture began in 1943. Their company had a display hall. It was like a museum of the electron microscope because it showed what the first electron microscope was like, how it was improved later and the electron microscope of today. Because they have special personnel conducting systematic research, their products are of the best quality. Thus, we should not regard technical personnel as nonproductive personnel. It is precisely because of the work of these technical personnel that their products are able to become what they are today. At present, the general trend of foreign manufacturing companies is having a greater and greater percentage of technical personnel. Their production is developing more and more. We regard technical personnel as people not engaged in production. This violates facts and also limits the development of technology and production of factories and mines. This backward concept must be changed. The percentage of our technical personnel should gradually increase.

Fifth, there must be an overall understanding of the function of basic research. Some people believe basic scientific research mainly serves a function of scientific preparation (after completing research, the results can be applied in production when necessary). This statement is correct but not sufficient. The so-called preparatory function has many meanings. One is that there must be a group of scientists with a relatively high academic caliber, and when necessary, they can join in researching major scientific and technical problems. For example, some of our scientists who studied elementary particles later wanted to develop the atomic bomb, thus these people were strategically transferred. Without such a theoretical team as reserve, the atomic bomb would not have been developed. The second is that certain academic fields must have basic research, and a definite standard must be achieved, thus when a major practical problem has to be solved, such researchers can provide advice and suggestions. But this preparatory function refers mainly to a service that will be performed starting from tomorrow. But basic research not only serves tomorrow, it also serves today. There are also two major functions. One is that it can improve the standard of our higher education and the theoretical standard of our scientific and technological circles. When the entire academic level is elevated, the understanding of problems and the views of problems will not be the same, and instruction will be better. Now we are training graduate students. We must gradually train

masters and Ph.D's. Only by developing basic research in a big way and by elevating our nation's academic caliber can we train high quality scientific talent. The second is that some results of modern basic research can quickly be assigned to produce new technologies and they can be applied immediately, such as genetic engineering. Therefore, it is not enough to say only that basic research can serve a function of scientific preparation. This belittles its function. The function of basic research must be sufficiently understood.

Sixth, we must change the attitude of emphasizing the purchase of whole sets of equipment and neglecting the purchase of patents. How to take over other people's technology should be our goal. We should import sample machines and imitate them by manufacturing them, or purchase technological patents and digest and absorb them so that they will become a component of our technological system. Foreign patents are usually for several years. After these several years, the patents are no longer exclusive, and everyone can use it. There was a period which we did not know and we paid for it without realizing it. These were all cases of being cheated.

Also, after introducing patents, we must also provide funds to create conditions so that the patents can serve their purpose. We also must have matched facilities. Take Japan as an example. From 1955 to 1958, it spent $15 billion buying foreign patents. To use and digest these patents, Japan spent another $50 billion, but the result was a saving of money and time. If Japan relied completely on its own efforts to develop such patents, it would have spent $150 billion and 10 years time, but the total purchasing cost was only $65 billion and the patents were obtained within the year. Therefore, the Japanese are still smart. What does this illustrate? This means that when we can afford to buy the horse, we must also be able to fit the saddle. Only in this way can we develop the function of imports.

Also, imported technology must be matched with our own research and development. Otherwise, foreigners will block us in certain key technologies, such as large-scale integrated circuits. When our 4K level integrated circuits had not reached the acceptable standard, foreigners would not sell us 4K equipment. When they heard that the Chinese Academy of Sciences made a breakthrough in 4K, they were willing to sell us low grade chips and equipment. Because we did not develop an acceptable magnetic disc which is the key peripheral equipment of computers, we asked a relatively friendly foreigner to sell us the patent but he refused. Therefore, everything must be done by relying on our own abilities. Without abilities, others will take advantage of you.

The guiding principle of developing science and technology is already clear, but to implement this guiding principle, there is still a lot of work to be done. For example, we must draw up the 5-year national economic plan and the annual plans which combine science and technology and economic and social development. We must reform the scientific research system. The distribution and utilization of scientific research funds must be more suited to the implementation of these policies. There must also be corresponding measures for cooperation in scientific research and academic exchange. We must adhere to

scientific ethics, establish a good academic environment, and the party should strengthen and improve its leadership of science.

There is another thing that is very important. This is to absorb scientists and let them participate in leadership work. Recently, the State Council decided to establish a center for the economy of technology. Special research agencies involved in the economy of technology are coordinated through this center to help the premier study related questions and to provide advice and opinions. This center consists of three groups of people: those who understand technology, those who understand economics, and those who understand systems science and management. It seems that with such a scientific and technical center beside the premier, science and technology have entered the seat of government. A province should also do this; science and technology should also enter the provincial office building.

Absorbing scientific and technical personnel to participate in party administration at each level will not present any difficulty in leading production, but will produce practical results. Comrade Wanli was the earliest one to use scientists. A professor of the China Science and Technology University served as assistant governor of Anhui Province. He was connected to the scientific circles. He could go to Beijing to contact many scientists. Anhui Province also has a branch of the Academy of Sciences and a science and technology university. This mobilized many scientists to propose ideas for Anhui. The Anhui Provincial Committee invited a group of Beijing scientists to come to Anhui to survey the Shipihang irrigation area under Dabieshan. They also surveyed the northern part of Anhui and they proposed very good suggestions. Besides the central government and the province, there are also counties. Science and technology should also enter country government offices. Guyuan County under Liupanshan is a very poor place. The Chinese Academy of Sciences and the party committee of the Ningxia Autonomous Region cooperated and they wanted to help this county turn its economy around. The county committee invited a party member and deputy director of the Northwest Water and Soil Preservation Institute of the Chinese Academy of Sciences to serve as the deputy secretary of the county committee. This is a very good thing. The whole nation has more than 2,000 counties. Every factory has a chief engineer. Why can't the counties establish a chief agricultural engineer?

Comrades, in the Romance of the Three Kingdoms, the chapter on matching wits to establish the three kingdoms is very famous. Liu Bei visited the hut of Zhuge Liang three times and Zhuge Liang lectured Liu Bei. The speech became the strategic foundation of Liu Bei's endeavors to found a kingdom. I regard the intellectuals of present-day scientific knowledge (natural sciences and social sciences) as the collective Zhuge Liang of our Party and nation. They hold the knowledge of modern science and we want to use them. Modernization without modern science and technology will not work. Some comrades said, China's scientists had never held power and it is feared that they will not exercise power well. Not having held power does not matter, it can be learned. Also, among the experts, there are many who have scientific and technical knowledge and who have organizational talent. Of course, scientists also have their shortcomings. Modern science is finely divided and knowledge is specialized. But when you place him at a reasonable post, he can join more

scientists to draw up plans and policies. Also, he has the basic knowledge of science and he has received basic training in science. When he encounters a problem, he will not act contrary to the common sense of science. The popularization of a new technology and a new product will also be easily understood and supported. The new product will not go astray, it will not be refused and unaccepted. Is there any danger in employing scientists by the party administration at each level? I see no danger. After many years of political campaigns, especially during the 10 years of civil strife, many scientists and our cadres were criticized and struggled against, and all have become friends in hard times. Also, China's intellectuals have a good tradition which is the tradition of Lu Xun, Guo Moruo and Li Siguang, "willing to bow their heads to be servants"! Also, intellectuals are a part of the class of workers, and they are the forces which our party relies upon. Why can't we use them? Therefore, we must absorb some scientists to participate in party administration to lead production.

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RELATIONSHIP OF MACROSCOPIC, MICROSCOPIC RESEARCH PROJECTS DESCRIBED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 8-13

[Article by Wu Junqing [0702 0193 0165] of the General Rear Services Department of People's Liberation Army: "On the Systematic Structure and Systematic Balance of Macroscopic Scientific Research Projects"]

[Text] Macroscopic scientific research projects refer to research projects of the state, department or region, microscopic projects are research projects of an individual unit, professor or program. They represent respectively the whole and the components of scientific and technological research, they differ from each other and yet they are closely related.

Because China is a socialist country and because the organization of modern science and technology has entered an age of unified coordination and organization by the state; also due to the large-scale and the complex and integrated nature of science and technology, microscopic research projects should be integrated into macroscopic research projects in one way or another. The socialist system makes the fundamental interests of the two types of research projects in China consistent, but there are also some conflicts. Under normal circumstances and especially in today's readjustment period, "microscopic" should serve "macroscopic" and "macroscopic" should play a guiding role to "microscopic." The enhancement of macroscopic project study is therefore highly significant in making scientific research policy and is a major task before us.

A macroscopic research project is a structured artificial system consisting of many elements. When we study a macroscopic project we should first investigate what levels and elements are in the system and how the elements are connected and related and what is the quantitative relation between the elements which when combined form an organic system. We should also study the effect of this quantitative relationship on the overall efficiency and what relative ratio would optimize the system efficiency. Here the overall efficiency refers to the quantity and quality of research results and talent expended by the state, the department and the region which eventually will show up as an import on the economy and society and the degree to which a predetermined goal is achieved.

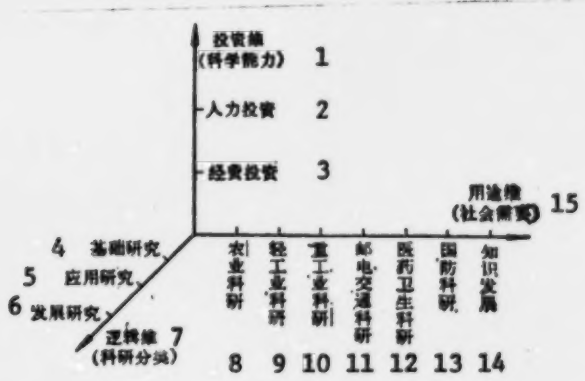
Using system theory we shall first analyze the system structure of macroscopic research projects in the space below. Then, based on the system structure, we propose the viewpoint of equilibrium in four systems; namely, equilibrium between research task and social need, equilibrium of the internal structure of scientific research, equilibrium of investment structure and the optimization of overall efficiency, as the basic requirements in formulating macroscopic research projects.

I. System Structure of Macroscopic Research Projects

To study the structure of a macroscopic research project we must dissect the system. Only in such a dissection can we recognize the component elements of the system and then proceed to study the correlation and relative ratio of these elements. After that, we can integrate, investigate and assess the overall effects of the system. The key question here is a proper dissection, without a proper dissection, scientific classification and correct understanding of the system will not be possible, not to mention neither will an in-depth study and overall optimization.

To begin dissecting a macroscopic research project, one should start with an analysis of the factors affecting the development of science and technology. Because the essence of studying a research project is to identify these factors accurately, formulating a research project amounts to understanding and treating the relationship among these factors properly. The development of science and technology is determined largely by three factors: the first one is society's need. Engels once said: "From the very beginning the generation and development of science is determined by production." Science and technology originate from production and social need, and end in production and social need. Society's need is a great driving force for science and technology development, and society's need is the mother of scientific invention. Research projects should therefore meet society's needs. The second factor is the internal structure and law of evolution of scientific and technological development. A definitive rule governs when a breakthrough occurs and in what field, when science transforms into technology and technology transforms into productive force, this rule is the internal logic of science and technology. Because in different countries and regions and in different periods of time the specific conditions and the degree of scientific and technological maturity are not the same, the probability of achieving research results is also different. Research projects should therefore match the evolution of science and technology. It should also be pointed out that the two above factors are related. Soviet scientists proposed a theory that social needs and science development meet at a point of intersection. Results and breakthroughs are most likely at this intersection point. It is therefore very important that research projects should not only satisfy society's need but also satisfy the need of scientific and technological development itself and the two needs should be reconciled. The third factor is the scientific ability of the society. Scientific ability is the ability of a nation, a region or a department to develop science and technology and it is also the material basis for scientific and technological progress. Undoubtedly, research projects should be compatible with the scientific ability.

Based on the analysis above, a macroscopic research project may be divided into three essential elements: social need, scientific classification and scientific ability, and each element can be further divided into various levels. These three elements constitute the three dimensions of the system structure, namely, the utility dimension, the logic dimension and the investment dimension, as shown in the figure below. We now discuss each dimension separately.



Key:

1. Investment dimension (scientific ability)
2. Manpower investment
3. Funding investment
4. Basic research
5. Applied research
6. Development research
7. Logic dimension (scientific classification)
8. Agricultural research
9. Light industry research
10. Heavy industry research
11. Telecommunication research
12. Medical and health research
13. Defense research
14. Knowledge development
15. Utility dimension (social needs)

1. Utility Dimension (Social Needs)

In the utility dimension, the utility classification of research is made based on social needs. We may use the industrial classification in the Chinese economic structure as a guide in making the division conducive to the implementation of the policy of science and technology serving the national economic and defense construction.

There are different divisions in industrial structure including the "two department division," the "three industry division" and the "agriculture, light and heavy industry division." The last method of division is more compatible with the current situation and actual needs of China. The utility classification can therefore include agriculture research, light industry research, heavy

industry research, telecommunication research, medicine and health research, defense research and knowledge development (without specific utility). Under these divisions, there could also be various levels; for example, in heavy industry research there could be metallurgical industry research, mechanical industry research, petroleum industry research, and so on. Defense research can be further divided into strategic weapons research, conventional weapons research and the latter can also be divided into aviation research, ship research, light weapons research, rear service equipment research and so on. Defense research can also be divided according to the armed services. On which level the divisions should be made depends on the scope of the research project; for instance, in a national research project the first level must be used (agriculture, light industry, heavy industry, telecommunication, medicine and health, defense and knowledge department).

2. Logic Dimension (Scientific Research Classification)

Science research is classified according to the internal logic of science and technology. A proper classification of scientific research helps to understand properly the status and role of various junctions along the road of scientific and technological development. By consciously following the law of development of science and technology, and making rational plans which take into account the overall situation, a normal order of research can be established. By making the organic connection of science--technology--production, science and technology can be transformed into a productive force as fast as possible. So far in China there has not been a unified method of classification for science research. Most people are inclined to divide it into basic research, applied research and development research. Any science or technology must go through these stages in its growth and development, this division reflects the development process of science and technology. Therefore, the logic dimension here is also the progress dimension, it not only represents the overall logic structure of science and technology but also shows how mature a certain science or technology is. Below the three major divisions, there again can be different levels. For example, for new product development in developmental research, there may be preliminary study, proposal study, full scale development (design, prototype, small batch production). Opinions on this division may vary and further study should be made.

3. Investment Dimension (Scientific Ability)

The basic components of scientific ability include the collective research ability of the scientific rank of scientists quality of experimental facility, efficiency of the library-information system, optimization of the labor structure in science, and the educational level of the nation as a whole. We do not intend to discuss scientific ability specifically; instead, we use the concept of scientific ability to study one element in the system structure of a macroscopic research project. Therefore, we have simplified and modified scientific ability and made it the investment dimension of a macroscopic research project. This dimension includes personnel investment and research fund investment, that is, we have condensed the material factors in scientific ability into the research fund. This dimension can also be further divided, science and technology personnel can be divided into senior,

intermediate and junior levels and research funds can be divided into capital construction fund, equipment fund and material fund, and so on.

II. Balance Between Science Research Task and Society's Need

The so-called balance between a research task and society's need means research efforts should meet social needs, it is also called utility structure balance. The content can be divided into two areas:

1. On the whole scientific and technological research should develop in coordination with the economy and society.

Economic and social development constantly put demands on science and technology and the progress of science and technology must satisfy the needs of economic and social development and promote economic and social progress. The role played by modern science and technology in the economy and society is no longer limited to the application of a single technological achievement, science and technology now have an important influence on a macroscopic scale on a nation's economic policy and development strategy. A number of issues are closely related to the development of science and technology, including the determination of a nation's goal in economic construction, economic structure reform, rational layout of productive force, sensible deployment of resources, technological improvements of enterprises, and the formulation of technological economic policy. But for a long time science and technology in China have been disjointed from economy and social development. Science and technology has not solved enough major problems in economic development and economic development has not relied enough on science and technology, each has made their own plans and projects and they are not connected. In order to have a coordinated development of science and technology, economy and society, the three must be treated as a trinity and given overall, balanced and coordinated consideration. Science research has a definite place in China's socialist construction and research funding investment should be a proper percentage of national gross product (or gross production value of industry and agriculture). In developed capitalistic countries, the national research investment is usually 2 $\sim$ 3 percent of the gross national product. In Russia it is 3 percent (see Table 1 for details). In China there has not been a definite number regarding the research investment percentage of the gross production value of agriculture and industry, it is probably less than 1 percent. Obviously, science and technology in China is not at all compatible with the economic and social development. The Central Committee has decided to increase gradually the proportion of research investment during the national economic readjustment period, it is entirely necessary. As to what percentage is most appropriate, further study and assessment as to practice are needed.

Table 1. Research and development expenditure (1970-78) of various nations as a percentage of gross national product*

Year	France	West Germany	Japan	Britain	America	Russia
1970	1.91	2.18	1.79	—	2.64	3.23
1971	1.90	2.38	1.84	—	2.50	3.29
1972	1.86	2.33	1.85	2.06	2.43	3.58
1973	1.77	2.32	1.89	—	2.34	3.66
1974	1.81	2.26	1.95	—	2.32	3.64
1975	1.82	2.39	1.94	2.05	2.30	3.69
1976	1.78	2.28	1.94	—	2.27	3.55
1977	1.79	2.26	—	—	2.27	3.47
1978	—	2.28	—	—	2.25	—

2. Science research for different applications should be coordinated and balanced.

In planning the national macroscopic research projects, research in agriculture, light industry, heavy industry, telecommunication, medicine and health, and defense should be laid out rationally and properly proportioned in an overall structure. In planning departmental and regional macroscopic projects, the structure and layout of applications must be properly solved as well. The national economy stresses the policy of "agriculture, light industry and heavy industry" [in that order], so the first priority in science research should also be placed on agriculture, followed by light industries that are labor intensive, require modest investment and have a pronounced effect. This is an important task in our current readjustment. There should be a proper proportion of the investments made on various applied research and this proportion is yet to be studied and tested. In foreign nations, their investments on the various applied areas are shown in Table 2.

*From "Data Compilation of Foreign Science and Technology Management," p 60.

Table 2. Percentage distribution of R and D expenditure according to mission in various countries*

Country	Year	Defense	Space	Energy	Economic Development	Medicine and Health	Social Social Services	Knowledge Development
France	1967	35	6	20	16	1	1	20
	1976	30	5	9	23	4	2	26
Japan	1965-1966	3	0.5	3	27	2	2	63
	1974-1975	2	5	8	23	3	3	55
Britain	1966-1967	52	4	13	14	3	0.5	12
	1975-1976	46	2	7	20	3	2	20
America	1966-1967	49	32	5	5	6	2	2
	1976-1977	51	13	9	9	10	5	4
West Germany	1971	15	6	16	13	3	2	41
	1976	12	5	11	13	3	5	51

III. Internal Structure Equilibrium of Science Research

Internal structure equilibrium of science research, also known as logic structure equilibrium, refers to the coordination and balance of different researches on the logic dimension of the macroscopic research system. For research projects on the national level, an appropriate and stable proportion should be maintained between basic research, applied research and development research on the basis of the internal rule of science and technology. For regional and departmental projects, such as a department engaged mainly in product development, there should be a proper balance of the four stages of preliminary research, proposal study, full-scale development (design and prototype) and small batch test production. For basic research, because it does not have clear-cut stages and its management is relatively reflexible, its balance on the logic dimension may be taken as the proportional equilibrium between various disciplines and the organic internal connection between the disciplines is manifested in such an equilibrium.

*From "Data Compilation of Foreign Science and Technology Management," pp 62-63. (Except the United States, all other countries include general expenses for universities in the knowledge development category.)

When a nation, a region or a department manages the various sectors of the research project on the logic dimension, it involves a coordinated and overall arrangement of the short, intermediate- and long-term science research. Science and technology itself is a knowledge system for understanding and improving nature, therefore a research project must be a dynamic development process and there must be a certain continuity and derivation. There should not only be science research for solving immediate economic and social problems, there should also be medium-term and long-term research to suit the future development needs of the society and the economy. A complete and well coordinated system of research should be formed so that the enterprise of science and technology may progress continuously and systematically with foresight and without interruption. If the science and technology development of a nation, a region or a department does not have foresight and reserve and is not prepared for anticipated events, then its vigor and life will be very limited.

Proper arrangement of various types of research and rational structural layout of the projects have a profound effect on the development of a nation's industry, agriculture, science and technology and defense. From the historical experience of some nations, generally speaking developing nations in the early stage of modernization should place their emphasis on applied research and development research. In the meantime, attention should be given to basic research as well and, along with the improvement of the economic base, basic research should be increased in proper proportion in order to promote the development of applied research. Bias against any one area would lead to adverse results. In Japan, for example, emphasis was placed on applied research and development research in the early stage of recovery after the war, and its economy developed rapidly, but in the late 1950's when its basic research should have been strengthened and was not given proper attention, it affected the smooth development of applied research to a certain extent. The Soviet Union has traditionally put 95 percent of its scientists on basic research and neglected applied research and development research, it was therefore in an inferior position in some technologies. In the mid-1960's they realized their situation and paid attention to changing it. China is in the early stage of its modernization construction, the emphasis should no doubt be placed on applied research and development research. The weak link of development research should especially be strengthened. In the meantime, basic research should also be allotted a proper proportion of emphasis and allowed to develop steadily (expenditure on basic research in China today is approximately 5 percent of the total science research expenditure). The ratio of applied research, development research and basic research should be determined on the basis of our resources, economy, technological force and needs in social and economic development. But the prerequisite and today's urgent task is first to have a clear understanding of our present ratio of the three sectors.

In order to learn from foreign experience, we have listed below the investment percentage on various researches in other countries.

Table 3. Investment percentage on various researches in other countries*

Country	Basic Research	Applied Research	Development Research
Russia	12.9	60.5	26.6
America	14	22	64
Japan	11	31	58
West Germany	12	24	64
Britain	12.5	26.1	61.4
France	17.5	33.9	48.8

IV. Investment Structure Equilibrium

The term investment here includes mainly two areas: research expense investment and scientific and technological personnel investment (manpower investment for short, same in below). The balances discussed above between the research mission and the social need and within the internal structure of science research must both be realized through the balances in expense and manpower investments, and investment balance is their quantitative representation. Through expense investment and manpower investment, macroscopic research planning is an implementation of effective control and management of the research mission based on the utility classification (representing the effects of science research on the economy and the society) and the internal logic classification (representing the progress and maturity of science research). It should further be explained that investment balance is in essence the macroscopic balance of research mission and research condition, i.e., giving the research mission proportional manpower and expenditure investment according to the weight and urgency displayed on the utility dimension and the logic dimension. The balance between the research assignment and the research condition has traditionally been the weak link in science research planning. In the past, planning was often just adding the topics together and assignment and condition were not balanced (this depends on the management system). But this balance happens to be an important condition for a smooth development of the enterprise of science and technology.

In addition, investment structure balance has two more implications, one is the mutual balance between expenditure and manpower investment and the other is the internal structure balance of each. The mutual balance refers to the coordination and equilibrium between personnel growth and expense growth

*From "Personnel and Expenditure Data of Russian Research Organizations" (Note: The division of development research is different in Russia and in America.)

(including additions of equipments). For a given research, the average amount of expense needed per annum by each researcher is usually some reasonable number. If manpower and expenditure are not balanced and anomalous development takes place then the scientific ability cannot be complete and waste will occur.

The internal structure balance of research expenditure refers to the proper proportion of various expenditures, including capital construction expenditure, equipment and apparatus purchasing expense, material and supply expense, library and information expenditure and expenses for collaboration. If these expenses are not in proper proportion, science research will suffer.

The internal structure balance of research personnel refers to the rational structure of various technological personnel. The numbers of senior, intermediate and junior researchers are usually in that order and show a pagoda-type structure. The ideal ratio of the number of doctors, doctoral candidates and nondegree personnel among researchers in Soviet colleges and universities is believed to be 1 : 3 : 16. There should also be a proper ratio of researchers, technical staff, support staff and research management personnel and this ratio varies for different types of research.

V. Optimization of the Overall Effect

We take the view that macroscopic research planning is a system and this system is like a precision machine. Manpower and expenditure investments are inputs in the system and research results and talent growth and the effect on the economy and society (collectively known as research results) are the outputs from the system. The project itself is the system's command and the function of the project is to adjust continuously the structure and proportion of the system, maintain relative balance in the system and keep the ratio of input and output in an optimum conditions (input-output equilibrium) and make the output satisfy the goals of the project, that is to say, optimize the overall effect of the research planning system. The rationality of the structure and layout of a macroscopic research planning system is appraised collectively by the overall effect. Therefore, the optimization of overall effect under discussion here is also the general equilibrium of the system.

The appraisal of the results of research investment is an complex question. This question should be a research topic and cannot be discussed in detail here. It suffices to point out that an overall direct or indirect evaluation of the research result is possible. We may use foreign experience as a reference in gradually establishing our own system for evaluating scientific research results. Today some countries use the following items as output (production) indicators of the science and technology system: the quantity of science literature, the quality and influence of science literature—the citation ratio, the number of international science award winners, major technological invention and innovation, patent differential (that is, the difference between the number of foreign patents obtained by the nationals of a country and the number of patents granted to foreign nationals; if the former is greater than the latter, it shows that this country is doing well in science and technology), technical patent exchange (i.e., the surplus or deficit in international patent

exchange, a surplus means good achievements in science and technology), labor production rate and foreign trade difference. Using these indicators to evaluate the scientific and technological enterprise in major nations, one finds that the United States is basically still in the lead. For example, from 1946 to 1979, there were 192 Nobel Prize winners in science, and of these the United States had 98 or 51 percent. An international specialist group selected 492 major technological innovations from 1,310 items in the 1953-73 period and of these the United States had 319 or 64.8 percent. America has always maintained a surplus in international technical patent exchanges. Its 1977 income was 4.725 billion dollars, expenditures were 447 million dollars and there was a surplus of 4.278 billion dollars. In the past 20 years the U.S. labor productivity rate has always been higher than that of other scientifically advanced nations like.France, West Germany, Japan, Britain and Canada. In 1977, for example, if we take the average U.S. labor productivity value as 100, then France was 84.7, West Germany was 79.1, Japan was 62.2, Britain was 55.1 and Canada was 91.6. Of course, the United States has made relatively large investments in science and technology, the absolute value of its research and development expenditure is among the highest in the world and its manpower investment is next only to the Soviet Union.

Based on the specific situation in China, we must strengthen our study of macroscopic science research planning, unify the classification of science research, perfect our planning and accounting system, consolidate historical experience and, based on the needs of the four modernizations construction, establish a national, regional and departmental macroscopic research planning system, rationalize its structure, maintain its equilibrium and optimize the results. At this time it would be difficult to make quantitative comparisons of our research results with that of other countries. We could however compare our present to our past and the future of the present and achieve a reasonable proportion in these comparisons and find a path that is suitable for China.

FOOTNOTES

1. Xue Yongying [5641 3057 2019], "Methodology in Economic Structure," CHINESE SOCIAL SCIENCES, No 1, 1981.

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3. Fan Dainian [5400 1486 1628], "From Science Indicator to Science and Technology Modernization," SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY, No 2,3, 1980.

4. Zhao Hongzhou [6392 4767 3166], "On the Society's Scientific Ability," HONGQI, No 4, 1979.

5. "Information of Science Research Expenditure in Scientifically Advanced Nations in the World" compiled and editored by Fan Dainian [5400 1486 1628] and Chen Yanghui [7115 7402 1920], published in "Data on Foreign Science and Technology Management," Defense Industry Press, March, 1980.

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SCIENTIFIC, SOCIAL ROLE PLAYED BY VARIOUS SCHOOLS OF THOUGHT

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 14-19

[Article* by Lu Taihong [4151 3141 1347] of the Jiangxi Institute of Science and Technology Information and Liu Dachun [0491 1129 2797] of the China People's University]

[Excerpts] Introduction

In Cohen's language, science development is realized in the succession of different "standards." A standard is chosen by a group of scientists and at the same time it determines the basic viewpoint and method of study of this group of scientists.

This group of scientists in a broader sense is also a school of thought. Science history shows that free competition between schools of thought leads to a continuous succession of old and new theories and is an important factor in science development. We often say that let all schools of thought compete. These are statements of the same principle in different words, because the entire history points to this principle of science development.

Schools of thought play a dual role in science and in society, they are not only a unique structure in science development but are also the products of certain social factors and the results of a mutual relationship between science and society. Schools of thought and the competition among them reveal an important aspect of science and society relationship. Science is a social activity, this is quite different from the superficial impression it often gives people. People often have the impression that science is the product of the individual activity of scientists and science appears to be purely in the realm of individual free thinking. This view does not reflect the true nature of science activity. Scientific activity is organized socially and schools of thought are simply a special form of socially organized science activity.

*This article discusses only schools of thought in natural sciences.

Since the question about schools of thought is so important, an in-depth understanding of the characteristics of schools of thought and their role will be very helpful in handling the laws of science development. A complete understanding of the schools of thought can only be reached by understanding their characteristics and functions and this understanding can then benefit the overall implementation of the policy of letting all schools of thought compete, and the management of science and technology.

The "let a hundred flowers bloom and let a hundred schools of thought contend" slogan put forth by Chairman Mao correctly pointed out that we must develop different schools of thought in order to advance China's science. We firmly believe that schools of thought have a major role in science and society and in the managment of science research we should begin with external factors to assist schools of thought and encourage competition.

First we must respect science autonomy. The first questions encountered in research management are whether to recognize the independence of science and whether academic problems should be settled within science or solved by external decision. Looking back in science history we must admit that science is a system with a certain self-regulating power and is a social state with a certain degree of autonomy. Even though science has been persecuted by religion and theology, bound by autocracy and superstition, eroded by idealism and metaphysics, as a whole science never "died" and on the contrary science has become more and more powerful. This indicates that science has an internal vitality and a certain regulating function. Just as the human body is a self-regulating system that may become maladjusted and confused under excessive external stimuli excessive interference in the science system can only bring about disruption of the internal order of science and cause the function of science to deteriorate, perhaps even giving academic fraud some opportunities for exploitation. In the Soviet Union, the Lysenko experience of the 1930's dragged on for decades, in 1940's the "new cell theory" was advocated, in 1950's it was proposed to "reform medicine with Pavlov's theory" and nullify Wei-er-he [phonetic] cell pathology, and in the controversy between the Michurin school and the Morgan school, the latter was condemned as "pseudo-science." The direct results of all these incidents is that academic frauds became the despots of the science profession and different schools of thought were persecuted as political opposition factions. These are the reasons that Soviet agriculture has long followed a tortured path and Soviet genetics lagged behind the West by several decades.'

Next, substitutionism and simple determinism should be avoided in the academic appraisal of schools of thought. Science history shows that a school of thought or an academic viewpoint does not have a simple one-to-one correspondence relationship with social status such as politics, philosophy, nation, region or faith. In other words, various ideologies of the society have a crisscrossed and multidimensional effect on the formation of academic schools of thought. This is why substitutionism or simple determinism will never work in evaluating the correctness of various schools of thought. In the Soviet Union the only recognized celestial evolution theory is the "Russian-made" capture theory of Schmidt and it is considered the real "dialectic materialism." All the other theories such as the galaxy theory or the mutation theory

are all "bad theories." But in the end the showy "capture theory" faded from the science arena and became a historical lesson. As to Hitler's "Jewish physics" theory, history has scoffed at it without mercy.

In a deeper sense, the internal bases for the existence of a school of thought are the different assumptions and standards with which the scientists try to understand the world. They are often based on different scientific beliefs, viewpoints and methods and there is a certain degree of incompatability between them. For example, in 19th century physics the school of particle theory of light led by Newton and the school of wave theory of light led by Huygens each insisted on their view and fought for several decades. It would have been impossible to make a judgment call at that time. In China there once was criticism against Prof. Wu Rukang [0702 3067 1660] on the question of the origin of man, in geology there was criticism against Prof. Chen Guoda [7115 0748 6671]. Resonance theory, control theory, information theory and quantum theory have all been criticized, but all these criticisms did not survive the test of time.

Finally we should be careful to avoid and overcome the residual feudalism in academics. Schools of thought and their competition are a high form of academic freedom. Various feudalistic consciousnesses are only internal obstacles and threats. In order to realize the socialist four modernizations, Chinese academia has a duty to counter feudalism just like the other professions.

In order to foster different schools of thought, academic superstition must be avoided. There are plenty of historical examples of those in power repressing the common people and authority making the wrong decision. Academic leadership should therefore avoid relying on direction by individual academic authority, and innovative academic viewpoints should be encouraged and protected in scientific publications and society activities. Similarly, science frauds are not infrequent in the history of science. In order to preserve a health competition among academic schools, we should especially maintain the dignity of research results, pay attention to talent recognition, promote science ehtics, and prevent faction activity. Einstein and the leader of the Copenhagen school, Niels Bohr, competed over a period of 30 years but they have always maintained an intimate friendship. This is a good example of respecting science ethics.

Today in China the climate for schools of thought formation in the development of science is gradually maturing. A new generation of successful scientists, influential academic centers and different schools of thought will gradually appear. Science research management should anticipate this situation and take advantage of it and give them assistance. One should not throw out the baby with the bath water or give up food for fear of choking. In the bigger picture, competition among schools of thought is one of the driving forces in science development and from the point of view of goals, letting a hundred schools of thought contend is necessary precisely for the purpose of reducing the pitfalls of academics to a minimum degree. A truly prosperous situation of a hundred schools of thought is a vivid realization of the high degree of democracy and civilization of socialism, let us all strive for it.

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POLICY REGARDING MISSION OF RESEARCH INSTITUTES DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 31-35, 26

[Article by Gu Jiugang [7357 0046 4854] of Shanghai Institute of Laser Technology: "Policy Study and Practice of the Mission of Research Institutes"]

[Text] The primary issue in establishing a research institute is to specify the guiding thought and determine the direction and mission of the research institute. Whether the policy regarding this question is correct affects the future of the institute directly and it is also an important sign of the decision ability and leadership art of the institute's leaders.

In the past few years, under the spiritual encouragement of the national science conference and the guidance of the party policy, the Shanghai Institute of Laser Technology conducted some policy studies regarding important issues that affect our institute for the sake of developing laser technology. We have obtained some preliminary results in this practice and consolidated some experience.

Part 1

I. Defining the Problem

Because of the interference and disruption by the "gang of four" extreme leftist lines during the 10 year turmoil, the Shanghai Institute of Laser Technology was turned into something which was neither a plant nor an office nor a school nor a research institute. it had neither a specific research direction nor fixed research fields. For a long period of time, projects were in confusion, management was backward and there were more people than jobs. After the fall of the "gang of four", our institute faced the serious question of where to go and how to continue. The proverb has it: "When decisions are not made as they should be the indecision itself becomes a problem." Therefore, an important policy decision for readjustment, consolidation and insuring the healthy development of research at the institute and mobilizing the initiative of all the technical personnel is to formulate a correct and practical research direction and mission as quickly as possible.

II. Investigate and Analyze the Current Status

In formulating the direction and mission of a research institute, one usually studies the following problems: (1) The actual situation of the field and technical development in China and in Shanghai and demands to the field by the national economy; (2) Foreign activity and experience in this field or technical development; (3) The nature, special features and laws of development of the field or technology; and (4) Research structure, potential and advantages of the institute in question. A correct and practical policy proposal can be formulated only after a thorough investigation and analysis of the current situation in terms of the questions listed above.

Laser technology is a new technology developed in the 1960's. After 20 years it has acquired useful results and proliferated widely. It has promoted the advancement of other science and technology. Today there are more than 30 countries which have laser manufacture organizations. In the past few years investment in laser research, volume of sales and number of researchers engaged in laser investigation have steadily increased.

China has a relatively early start on laser technology and developed its first laser in 1961. There are now 21 laser research institutes in the nation. Laser research in Shanghai began in 1963 and now there are 180 units engaged in technical research, production and application of lasers and a result of almost 100 research achievements. Commercial units of the common laser and its element and material are now available and statistics show that the gross value of production in 1979 and 1980 have exceeded 7 million yuan. Lasers are broadly used in industry, agriculture and medicine.

Lasers have been in existence only 20 years but the enormous accomplishments generated by their production indicated a strong vitality and a bright future for application; this is unusual in the history of science and technology. Hence it is highly significant that China has made laser technology a high priority new technology for development. However, because of the interference and disruption of the Lin Biao "gang of four" extreme leftists, plus problems in our own work, the development of the laser industry was affected. The major problems in the current laser work are chaotic management system, lack of unified planning, each system going its own way, no clearcut division of work among the units, everybody jumping on the hot topics while no one is working on topics that are particularly necessary and in short supply and large amount of low quality duplication. Products that can be offered are very few in number.

The Shanghai Institute of Laser Technology was established in 1970 and since that time, even though the institute suffered serious intervention and disruption by the "gang of four," we have made a great effort in the past few years and obtained some research results. Relatively good accomplishments have been made on the promotion of laser application and a preliminary professional research team of high quality and vigorous young researchers has taken form. We now have more than 200 technical staff and more than 100 technical workers. At the same time we are in possession of facilities for basic science experiments and integrated experimental shops equipment with light, mechanical

and electrical systems and the institute has laid down the technical and material foundation for future development.

After this investigation and analysis, the basic situation is understood. In terms of basic research, although we have a certain ability to conduct applied basic technology research, we do not compare favorably against research institutes of the Chinese Academy of Sciences and universities and colleges. In terms of batch production, although we are somewhat more adaptable, we are still inferior to professional plants. But in the area of basic technology and applied research, we have certain advantages in adaptable and coordinated technology and our ability is beyond that of an ordinary local research institute. In terms of test production ability, we are also superior to other comparable institutes or specialized plants in China.

III. Determine Goals and Formulate Plans

Under these circumstances, we listened to the opinions of superior administrative departments and associated specialists and after repeated analysis, screening and consolidation, we have finally determined that the Shanghai Institute of Laser Technology should be a specialized research institute devoted to the technical research and development research of laser application. With several years of effort, our institute should develop into a unique specialty research institute in China that has a relatively high standard of research and technology and can provide both small batch advanced laser products and a broad range of technology application. The long-term goal of development is to gradually form a combination of research, development, production, sales and service and make more contributions to China's development of laser technology and national economy. The specific plan is to emphasize applicability and economic effect in research and, concurrent to research, strengthen our ability to test production and technical service to satisfy the needs in the popularization of laser technology applications. Centered on the primary mission of serving the national economy, we should organize an effort to produce small batches of laser products (including the laser, elements and the whole system) and the associated parts and actively develop the sales and technical service of laser products.

Part 2

To a research institute the determination of its direction and mission is equivalent to a strategic decision. To carry out this strategic policy and proposal, however, one must make many tactical decisions and specific plans.

I. The "Five-Fixes" Policy and Its Implementation

At the end of 1978, after the direction and mission of the institute were determined, we further proposed new tactical decisions. An institute-wide consolidation centered on research and consisting of the "five-fixes" was initiated. This was an important measure politically to eradicate from the research field the extreme leftist epidemic, it was also an important step to consolidate and readjust the organization, it was even more of an important

insurance for promoting research production, and talent and result output to satisfy long-term development.

The "five-fixes" refers to fixed direction and assignment, fixed topics, fixed conditions, fixed system and fixed personnel. It is a difficult task but without the "five-fixes" the institute's strategic policy cannot be accomplished. If the research assignment were not fixed, all the researchers would be doing nothing; if the equipments were not fixed, there would be unscrupulous waste; if the regulations were not fixed, it would be impossible to do things according to the laws of science and economics; if personnel were not fixed, there would be more people than jobs and "eating out of the big pot" and there would be researchers improperly assigned and unable to develop their talent. It is difficult to fix the assignment but it is even more difficult to fix personnel. The difficulties are that there are too many ideological problems and too large a workload and the decision is mostly a policy matter. However, "a rolling stone collects no moss," we can overcome the pitfall of "not learning what one would be practicing and not practicing what one had learned" only by circulating the personnel in the framework of fixed personnel. This was a key tactic policy of our institute.

In carrying out the "five fixes" policy, to both the researchers we kept and we let go, the principle of "letting everyone develop his talent and making full use of the talent" was adhered to. The spirit of unified arrangement and full responsibility was firmly upheld. If a person could play a role by remaining in the institute, he would be kept whenever possible; if a person could not play a role in the institute, then he would be transferred to a more appropriate place whenever possible. Every effort was made to make the outgoing people happy and the remaining people feel secure. Through the "five fixes," more than 50 comrades were transferred out of our institute to new posts, in most cases the arrangements were properly made and these people were able to function relatively well in positions matching their specialty. At the same time we have also conducted technical evaluation on all technical personnel and promoted 61 research assistants and engineers. In addition, some core researchers were transferred in from other units to strengthen our ranks. After the "five fixes," our technical staff became a refined, vigorous young team of quality that had a faster growth and put the various tasks of the institutes on the right track. The "five fixes" was the successful first step in realizing the strategic goal of our institute.

II. Regarding the policy of "expanded research institute autonomy test point" and its implementation

As research and production continued to develop in 1979, we fought our second battle, namely, carrying out the policy of expanded autonomy test point. The objectives of this policy were to manage research production by economic means so that research and the national economic construction could be tightly joined and to promote a faster development of research by means of the favorable conditions of an expanded human rights and financial rights so that the research-development-production-sales-service complex could be formed. Expanded autonomy was something that has never happened in our institute; if the decisions

were not made in a bold and yet prudent fashion, then the expected results could not have been obtained. Hence the entire process must be carried out meticulously. We designed the policy and implementation steps carefully. The procedures consisted of mainly the following steps: (1) Based on the questions raised, collect information and analyze the situation; (2) On a predictive basis, clearly define the goals and specify the requirements; (3) Design a few implementation plans for the expanded autonomy test point; (4) Assembly various representatives, especially experts from academic committees, to evaluate and compare several proposals and select the optimum proposal by weighing the pros and cons; (5) Conduct local experimental verification of the selected plan to observe the results and use it as a feedback to the decisionmaking; and (6) After the success of the local test point has verified the practicality of the policy, strengthen the feedback and make necessary corrections before putting it to general implementation.

These necessary steps put the policy through the repeated tests of predictive discussion, comparison, argument and actual verification. Since we started our autonomy expansion test points, because the decisionmaking process directly reflected the objective logic and rules of the policy, encouraging results have been obtained in the past 3 years. From this experience we have realized the following advantages of expanding the institute's autonomy: (1) It promoted the coordination between research and production and promoted the economic effect in science research. The source of research assignments in the past came largely from literature search, since it was often removed from actual application, the efficiency has been poor. Now that more attention is placed on actual technological problems in production, and research contracts are actively sought after, more contributions will be made toward economic development. For example, the successful development of six equipment items (holographic photoelastometer, holographic titration spectrograph, laser velocimeter, helium-neon laser, CO_2 laser and laser modulator) was scheduled from the very beginning according to actual needs or research contract. Because research and application were closely coordinated and goals were clearly specified, good economic results were obtained and the accomplishments played a role in the national economy and scientific research. The technical specification and performance of some of these products have reached the advanced level in China, some of them have filled a void in China and some have approached the advanced international standard. These items have been an important financial source of income to our institute during the past several years. The research income and product income of three items alone—holographic titration spectrograph, photoelastometer and high power helium-neon laser--have reached 1 million yuan. (2) It promoted the commercialization of research products. Many researchers have changed their original attitude of noninvolvement and worked hard to turn sample and display specimens into products and commodities. For example, the He-Ne laser group and the CO_2 laser group kept improving the power and lifetime of the devices and designed and test-produced serialized products based on different needs of the customer. This has not only increased the competition in power among similar products but also contributed to the promotion and application of laser technology. In the meantime, research was conducted according to laws of economics, research results were transferred with compensation, both the buyer and the seller assumed economic responsibility and the direct transformation from

research results to productive force was expedited. (3) It prevented blind initiation of new projects by selectively supporting the meritorious projects with economic backing. Selective support of the meritorious projects comes from economic management. Together with an improved ability to compete it makes us more prudent in initiating new topics and prevents the danger of being washed up in the selection due to low quality and repetitious research. Applied research should be made relevant whenever possible. Moreover, the economic accounting of the projects has made the entire research operation calculated more carefully in spending manpower, material and funds. (4) It helped to mobilize the initiative and improve the efficiency of research. After the promotion of the research contract system in the test run of expansion of the autonomy of research institutes, economic effect and economic responsibility have been improved and attention was given to the interests of the state, the unit and the individual simultaneously. In the last 2 years, our institute has finished more than 90 percent of the research projects. Thirteen research achievements were obtained in 1979 alone and 8 out of those received major research awards of Shanghai Municipality in 1979. In 1980, nine more achievements were accomplished. In terms of income, the institute had more than 500,000 yuan of income in 1979, or 1.8 times greater than that of 1978. In 1980 the income has doubled again and increased to 1.13 million yuan. The institute has not only contributed to the state but also further increased the development fund for research production and at the same time increased the funds for group benefit and staff award and motivated the socialist activeness of the staff and workers. (5) It advanced the improvement of research management. By conducting economic management, the research assignment takes on a clear awareness of economics and time. Various leaders and managers have also further improved the responsibility system. Prompted by the test point effort, we have established and perfected a management system since 1979, revised the limits of functions and responsibilities of various departments and the responsibility system of individual posts, gradually reduced the ranks of nontechnical and nonproduction workers and correspondingly increased our management quality and work efficiency.

Working toward the strategic goal set by the institute for the last 3 years, we have carried out a series of specific decisions and put them into action and greatly promoted the development of our institute. "Practice is the only standard for testing the truth," the practice of a policy decision is a test of the policy itself. Facts have shown that our overall policy and specific decisions are correct and productive.

Part 3

In the process of policy study and implementation, we have realized keenly that the success of a policy really depends on the following three factors: information processing system, quality of the decision maker or the decision-making group and a capable advisory team.

I. A Complete and Accurate Information Signal Processing System

The strength of the decisionmaking ability to a large degree depends on scientific method and the complete and accurate acquisition, analysis and

integration of large quantities of information and feedback signals. The process of decisionmaking is in fact a process of analyzing, screening, and processing this large amount of signal. In the determination of the mission direction of our institute, for example, it would have been impossible to determine the goal and formulate the plan without conducting extensive investigations and collecting large amounts of data. The collection and processing of signals are therefore necessary prerequisites of decisionmaking. Our approaches in establishing and utilizing an information system are as follows: (1) Based on work requirements, make the necessary organization healthy. Except for organizations of ordinary function and basic offices, we have, based on the needs, channeled all the problems on research direction and assignment and various academic problems to the institute's academic committee or office for study and action. All problems regarding research policy and economic management were directed to the autonomy expansion test point group for study and action. Routine study of the literature and the collection of research news were handled by the information data office and the information was processed periodically in the form of journals and briefings. (2) In order to improve the accuracy and utilization rate of the information, the system should not only extend vertically but also horizontally. In practice we gradually established a system of three meetings, namely, the institute director business meeting, the party affairs meeting and the institute-wide research production coordination meeting, and formed a crisscrossed information network system. (3) We used different methods and channels to follow information outside the institute. We tried to produce information sources whenever possible by relying on the routine activities of all the institute personnel including on-leave research, academic exchange, technical appraisal and business trips. As the saying goes, one should "look in six directions and listen from eight corners."

Thus, in actual practice a continuous flow of information will be transmitted rapidly, accurately, and directly through the system and network to the advisory board of the decisionmakers and provide reliable information for the leadership to make correct decisions.

II. A High Quality Leadership Group

The leadership or leadership group is not only the policy maker but also the implementer; their quality and leadership technique are often the key to the success of the policy. The formation and generation of a policy does not just happen on its own and is not based on the subjective speculation of an individual. Instead, it is a complex process of repeated analysis, reasoning and judgment that involves a great amount of information. The individual or group of individuals completing this process must be of high quality and leading ability. Unqualified or incompetent leaders and shoddy leadership may lead to wrong decisions which can jeopardize a unit or even undermine our entire cause. We believe that a decision maker must have the following qualifications: (1) He must have a strong sense of duty and a strong desire to achieve. This is a prerequisite to decisionmaking ability. A leader without a grand design in his mind will invariably be occupying the position without doing the job and he would delay, procrastinate, or shift responsibility and timely, firm and correct decisions could never be made. A leader can acquire the skill and art of leading by being enterprising, aggressive and by studying

hard and thinking more. (2) A decision maker should have a keen and unique ability to comprehend and observe. Research units often have to deal with many new problems and the leader must make many unconventional decisions. The leader must therefore never stop learning new knowledge and must continuously consolidate experience of his own and others. One can remain in an unbeatable position only by making timely policy revisions according to the development of the situation. (3) A decision maker must be good at independent thinking. Everyone has his own way of independent thinking. It gives the decision maker a correct understanding of the situation and prevents him from being swayed by a one-sided view or opinion of the majority. He can then weigh the merits of different opinions and come up with the right decision. Many new discoveries and new topics are frequently unexpected, the decision maker must timely and flexibly change a part or most of the established plan so that a good opportunity will not be missed. Independent thinking can often broaden the scope of observation of a decision maker and allow him to consider plans strategically. It can therefore improve the quality of decision making and make it more creative while at the same time improve the leadership quality. (4) A decision maker must be good at using favorable factors and know how to assign jobs. The work after the decision is very important, the selection of a decision is only the beginning of decisionmaking and the key to success is the implementation of the decision by the entire staff. A decision maker should therefore make every effort to have his decision acceptable to the public and broadly mobilize the initiativeness of everyone to implement the policy.

III. A Capable Advisory Board

The knowledge and ability of a leader or a leadership group are limited. In making major decisions, the participation of advisors and think tanks are needed to make the decisions correct and more effective. The advisory team mainly consists of members of the academic committee who have business specialties and members of the autonomy expansion test point organization who are knowledgable in policy. In addition, a decision maker should also solicit the opinion of some technical staff who are not on the advisory team but are ideologically active. This is an important aspect of following the mass line and respecting the experts. We should always watch out for the pitfall in which the ones with the decision powers do not know science and the ones knowledgable in science do not have the decision powers. If we can prevent that from happening, then the close tie between leadership and experts can be insured.

The art of decisionmaking is very multifaceted and it changes with the situation. One can manage the new leadership art of decisionmaking only by constantly studying the theory and summarizing the work.

Over the last 3 years, the leadership of our institute has made some preliminary progress on improving the decisionmaking ability. Through constant learning, practicing and exploring, we have further realized that, although there are many different ways to improve the leader's ability and technique of decisionmaking, the most fundamental principle is to stick with the basic view

of materialism dialectics and to insist on doing things according to the laws of science. If we make full use of the various ways and means of science and consciously guide the decisionmaking with them, then we can always formulate correct policies. Victorious generals on the battlefield are often described as achieving a victory while thousands of miles away by planning and operating, this is because the art of decisionmaking was first used in the military. Today the study of scientific decisionmaking has received the wide attention of leaders and many victorious generals in science research will no doubt come on the scene as scientific research continues to develop.

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MANAGEMENT OF ENGINEERING RESEARCH SUBJECTS DESCRIBED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 38-41

[Article by Lu Naiqian [4151 6621 6197], Xing Zhenyi [6717 3791 5030] and Wu Pingsen [0702 1627 2773] of the Shenyang Branch of the Chinese Academy of Sciences: "Characteristics of Engineering Research Projects and Their Management"]

[Text] The subjects of scientific research can generally be divided into basic research, applied research, and development research. Engineering research subjects of a research institute are usually large-scale and comprehensive research projects. They are often urgent defense and military subjects or major subjects in the national economy such as research on astronomy satellite and resource satellite. These comprehensive researches are generally interdisciplinary in nature, they not only involve the research of new material, new technology and new method and the fabrication of new components, they also involve theoretical studies of an applied nature.

The essence of management is an effective control of the management object based on its characteristics and regularity. The management of scientific and technological research must also be conducted according to characteristics of the subjects.

In the development of science and technology since the 1940's, foreign countries have acquired successful experience from major engineering research such as the "Manhattan project" in which the United States developed the first atomic bomb and the "Apollo project" of sending a man to the moon and the "project evaluation technique" used in the research and development of the Polaris nuclear submarine. In the meantime, computers have been used in foreign management projects. Foreign experience may serve as our reference and inspiration but because of the objective material limitation and the difference in national situation, we could not, and should not, simply copy their experience. We must study management problems of a different nature on the basis of our scientific situation. In this article we summarize our experience and discuss the characteristics and management of engineering research subjects.

Characteristics of Engineering Research Subjects

(1) The comprehensive nature

Engineering research subjects of a research institute are usually multidisciplinary and multiprofessional comprehensive research topics. Examples are artificial satellite heat shield and high temperature antenna worked on by a certain institute. The institute not only had to solve problems of metallic material but also had to develop and fabricate components and provide a test piece or the first quantity of real objects. This involves a series of technological problems (such as welding, forming, machining and heat treatment) and technical problems (such as inspection, analysis and testing). Not only must each technology and technique withstand the challenge of application conditions, more importantly, each technique and technology must also be closely matched with the material and the designed use so that all aspects are in coordination and compatible and a comprehensive ability to solve engineering research problems can be formed. In order to solve the problems listed above, it is often necessary to solve some related problems simultaneously such as cause analysis, damage mechanism and other application theory problems. This has given the management of engineering research topics some distinctly different characteristics and more complex factors than the management of other subjects.

(2) The systematic nature

In general, engineering research subjects not only include research and trial manufacture but also design and application. The scope of engineering research is broad, the work is heavy and the factors affecting engineering research are complex. Thus, research-trial-manufacture-expanded experimentation form a system and design-research-application form another system and engineering research subjects are themselves an organic system. The management of engineering research subjects is therefore the management of a complex system.

(3) The mission-oriented nature

Topics in engineering research are usually urgent tasks required by the state or the departments and they differ from the ordinary exploratory research. They have a specific timetable and technical requirement and are usually required to provide finished products to the user. Major engineering research projects are required to be not only of high quality but also "fail-safe." Hence this type of research has a distinct mission-oriented character and, in terms of management, one must consider not only its research nature but also its mission-oriented nature.

The integrated nature, systematic nature and mission-oriented nature of engineering research topics dictate the management to be characteristic of ordinary science research management and have some character of engineering management. This management must be organized to the integrated, systematic, and mission-oriented nature of engineering subjects.

Management According to the Characteristics of Engineering Research Subjects

(1) Choosing project leaders according to the nature of the subject

Engineering research subjects form a complex three-dimensional dynamic system. The management of an engineering research topic is essentially the management of a system. The most important job is to choose the right people to lead the system and the subsystems. Just being an expert is not qualification enough to be a project leader, a comprehensive ability is required as well. In our experience in engineering research, leaders of a topic (system) or subtopics (subsystems) should have the following qualifications: (a) Not only a broad knowledge but also a strong ability in solving engineering research problems; (b) Not only an expert in a field but also a capable organizer; (c) Not only capable of solving actual problems in person but also good at cooperation with others and making full use of the momentum in different areas.

A key step toward sound management is the selection of topic and subtopic leaders based on the above criteria. In order for the responsible people to play a full role, there must also be clearly defined duties and responsibilities. Awards must be granted according to merit and achievements should be given timely praise and used as a basis for promotion evaluation. Inadequate performers should be given timely criticism and help. In major engineering research projects, full-time or part-time organization management personnel should be assigned according to actual need to help the leadership understand how the situation is progressing, solve problems and move the project forward.

(2) Timely organization and coordination should becarried out based on the nature of the subject and following the procedures of scientific research

Once the goal of the research and development mission is finalized, the first order of business is to justify the research plan. This justification is of great importance for engineering subjects because of their broad and general nature and because of the considerable manpower and material investments put into them. Since the schedule is tight and the work is heavy, the decision of research direction and technical proposal should be done carefully to avoid missing the opportune time and causing losses. For example, the development of a high temperature component used in space flight by one of the institutes involved the following aspects: research and development of heat resistant material, investigation of machining and shaping technology, study of welding techniques, high temperature thermal coating research, investigation of nondestructive testing and setting up screening experiment facilities in simulated service conditions. All these areas must be mutually compatible and closely matched so that the mission may be completed on schedule in a coordinated progress. Therefore, when the plans are being discussed, project personnel as well as experts in the profession should be invited. Discussion should include the following areas: current status and trend of development both here and abroad, major components, approach and technical proposal of the research, milestones of the research effort, timetable and technical targets of each stage and expected completion time, equipment, material, and

capital construction needed in the project, total investment, annual budget and personnel replenishment, and so forth. Economic benefit must be taken into account in research and development. Comparison and analysis of technical and economic targets must be conducted in order for developed products to overcome the undesirable practice of not considering the cost in research. The main points in justifying a project plan are the approach and the technical plan. Through discussion, key points and the main emphasis of the development can be identified and appropriate actions taken accordingly. For example, in the development of a satellite high pressure vessel, there may be several proposals on material choice to satisfy the technical requirement: using low alloy, high alloy, super strength steel, or titanium alloy, the shaping technique might use punch pressing, rotary pressing or hot mold forging, and the welding technique may be argon arc welding, plasma welding or electron beam welding. In deciding which of the possible plans may be chosen as an acceptable one, decisions should be made on the basis of the mission requirement and various experts and technical personnel should play a full role. Through repeated discussion, verification and analysis, a practical, reliable and economic material and technique may be chosen.

The nature of engineering research topics requires the research and development unit to cooperate closely with the design and application unit in the development process. Design concept and service requirement should be communicated frequently in a number of ways, such as asking the design and service unit to provide design basis and reference data. Major technical specifications should be repeatedly studied and thoroughly understood. Another aspect is that, because of the limitation of various specialties, it is very difficult for the design staff to have an overall understanding of the material and technique and they may not make the most rational and economic material choice; on the other hand, the technical staff engaged in material and technique studies are unfamiliar with the service condition. Thus, the research management must organize the material and technique people and the design and application people and let them overcome their weakness by acquiring the other's strength through discussion, on-site visits and experimental participation. In one of the development assignments, it was required to punch grooves on high melting point metal plate. In the beginning, material was prepared according to the vertical and horizontal malleability specification submitted by the designers based on their information. But cracking flaws frequently occurred in the shaping process of punch pressing. After further study and analysis, the specified requirement was really the forming ability. To improve the forming ability in punch pressing, the rolling technique was improved. The original unidirectional rolling was changed into commutating rolling. Although this has made the horizontal malleability lower than the specification but each plate was successfully formed and thereby solved an old difficult problem of forming and satisfied the mission requirement.

An obvious feature of engineering research is that design development and application must form an organic system. In order to optimize the system performance, not only material and technique studies should be made according to design and service requirements, in the meantime the information obtained in the material selection and manufacture technique study should also be fedback in a timely fashion to design and service so that adjustment and

investigation consistent with practical needs can be conducted continuously to insure the smooth progress of engineering research and to obtain the expected results. Experience has proved that this is an effective method for speeding up research and insuring quality. In order to make timely exchange of information, research units should also send their staff to participate in the evaluation tests conducted by the application department so that they can be on top of the experimental situation and the material and technique related problems revealed by the experiment. This would help to accelerate the overall analysis and problem solving. In one of the engineering research and development projects the design and application unit requested the fabrication of a high radiation coefficient material. After screening and tests, the research and development unit came up with a high radiation coating which yielded good results under static tests. But in service performance tests the coating was found to show peeling effects under high temperature flushing. Later some bold technical innovation was made and the original coating method was changed. Based on the technical specification, a new method of obtaining high radiation coefficient was developed which solved the flushing and peeling problem altogether and satisfied the mission requirement.

In addition to timely communication between the research unit and the design unit, summary exchange should also be organized after the development work has progressed to a certain stage. The exchange of work summary, technical report and coordination between different units should be conducted simultaneously. Technical difficulties can be explored together in these coordination and exchange and conflicts may be identified and resolved. Through this practice, the design, application and development departments may be integrated into one entity. For example, in the development of the microthruster that controls the attitude of the astronomy satellite, a joint effort was made by the design unit, propellant development unit, and thruster material, welding, machining, and thermal protection units. Although these units are different in terms of academic field and specialty, the product they developed was used in the same subsystem. Because timely coordination and exchange were made and the units cooperated very well, it took only 2 years to complete the basic development of the prototype and progressed faster than the development of the whole system.

(3) Effective measures should be taken to insure quality.

How to insure the quality of engineering research is a pivotal question. In the past we used engineering management method as a guide and set up quality control cards for the developed components. To guarantee the quality of the development we must first establish inspection and verification standards for the parts. Since quality improvement is involved in the entire process of research and development, a rational standard for inspection and verification is often established with the successful development of components. A better method is for the design unit and the development unit to consult and determine quality standards for the various stages of development based on service requirements and the practicality of the techniques at different development stages. The inspection and verification standard is finally determined after an overall evaluation of the service performance. Different

quality standards may be formulated for different stages of the component such as preliminary specimen, test specimen and regular specimen. Each stage should be modified, supplemented and perfected based on experimental results.

To have each working process implemented rigorously in accordance with the quality standard, we must establish operation standards and a clear-cut technical post responsibility system and assign someone to be specifically responsible for quality inspection. Quality inspection circulation cards should be set up based on quality inspection standards. They have the function to transmit a timely quality information record of the components. The following information should be included on the cards: all the inspection items in the inspection and verification standard, quality inspection and appraisal results for each working process and the signature of inspectors for each process. To insure quality control in the development process, we must have a specific rule that once quality problem appears in a certain process, it should not be allowed to go on to the next process so that problems may be discovered in time and corrected in time. Once the product is finished the project leader or the institute's science and technology office should summon a joint quality inspection meeting where the responsible people for each working process will conduct an overall quality evaluation of the component based on quality inspection and verification standards. Components meeting the quality standards will be approved by the unit and sent to other units to be used.

The card method described here has been successfully used in several priority engineering projects. We have double checked several tens of thousands of measurement data points on developed components and did not find one error. The continued improvement of component quality has insured the reliability and repeatability of the developed parts. Experience has shown that using quality circulation card is an effective method to transmit quality control information and to guarantee the development quality of an engineering research.

(4) Organize the task group and carry out unified management

Specifically for the interdisciplinary and interprofessional nature of engineering research, one of the institutes must organize a task group that is above the research offices for the sake of a smooth progress of the research effort. In carrying out a centralized unified management, the project progress and quality control are both unified and coordinations within and without the institute are also unified. The technical personnel in the task group still belong to their respective research offices in terms of organizational relation, the task group is a temporary flexible organization. Only mission-related scientific research is unified, coordinated and directed by the task group and the research office and groups should assist the task group to insure a successful completion of the assignment. The task group must have the support of the institute leadership and possess a certain authority if it is to be flexible in coordination and quick in problem solving. The person in charge of the task group should devote some effort to policy-type work such as decisions of test programs, quality control, project summary and general evaluation. The routine organizational coordination such as quality

management, implementation of progress schedule and coordination of progress are duties of specially assigned people by the office of science and technology.

To insure the completion of the overall research and development project schedule, a unified project timetable must be set up and the relationship and progress of the mutually constraining and coordinating subtopics should be displayed graphically. The project schedule is a unified progress arrangement imposed on each working process so that the overall mission requirement can be satisfied. In the schedule, different parts of the task and various working processes are arranged according to their sequential order on the time coordinate. If several or a group of components are being developed, then there may be several development schedules going on simultaneously. These development lines constrain and cross each other and the development period of the entire component group is determined by locating the weak links in development and the development line with the longest period. The organizational coordination activity of the development is therefore centered on solving the weak leak and the work with the longest period. The linkage between the working processes is also worthy of attention. In order to guarantee the progress of the development, we must be practical in formulating the schedule and pay attention to discovering and solving problems in the development process and carry out some local readjustment. In formulating the overall schedule, responsible persons for each working process will report the time required for the completion of each process and general consideration will be made to identify those processes that may proceed in parallel or in alternation. Based on the coordination of different parts in the whole system, an overall development progress schedule can then be formulated and issued to various subsystems and working processes for earnest implementation.

The management method described above is a strong insurance for the completion of a series of engineering research assignments.

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LOCAL DEVELOPMENT IN SCIENCE, TECHNOLOGY DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 65-67

[Article by Yu Shangwei [0827 1423 1218] of the Jiangxi Provincial Institute of Scientific and Technological Information: "Several Problems Concerning the Plan for Local Development in Science and Technology"]

[Text] In June and July 1980 we investigated the result and application of major scientific research projects of local industrial, communication, financial and trade profession in the several years before the Third Plenum of the 11th Party Central Committee for the purposes of consolidating experience, drawing on the past lessons, correctly formulating local development plans in science and technology, improving the actual application of technological results, combining science and technology more closely with the material economy and serving the current local development of the national economy.

In those several years, the industrial, communication, financial and trade professions in this place have used a total of 13 million yuan three-category expenses on science and technology and conducted 188 applied and development research projects including 73 new product experimental manufacture projects, 12 intermediate testing projects, and 103 major scientific research projects. The survey has verified that 111 projects or 59 percent of the total number of projects have been completed at a three-category expense of 4.8 million yuan or 36 percent of the total expenses; 77 projects or 41 percent of the total number of projects were not completed and the three-category expense of the uncompleted projects is 8.8 million yuan or 64 percent of the total expenditure.

The application and popularization of completed projects may be divided into the following cases.

The first case refers to projects that have already been applied and popularized, experimentally manufactured new products have already been put into official production, technological results have been applied in the development unit and promoted to other professions and units and have had relatively large effects on the construction of the national economy. There are a total of 18 projects in this category, representing 9.6 percent of projects that should be applied and promoted. Among then 13 projects were completed by

plant and mine enterprises, 4 were completed by research institutes and only one project was completed by an institute of higher learning. Most of these projects are experimental manufacture of new products that sell well, none of them is intermediate testing.

The second case refers to projects that have been applied but not popularized, 64 projects or 34 percent of projects that should have been applied and popularized belong to this category. Some of these projects have had milestone results of relatively high scientific and technological standard, a few prototypes and samples have been tested in production and showed potential economic advantage. If experiments were continued into industrialized production, pronounced economic benefits would have been derived. These projects share a common feature, they are all completed with the cooperation between plant and mine enterprises and scientific research organizations or institutes of higher learning. Some of the results have been applied in host units with certain economic benefits, they could have been promoted to other professions or units but were not. Some of the results were applied to production but due to various reasons were discontinued later.

The third case refers to projects that were not promoted or applied. These projects were completed, even passed research appraisal, but the results were never applied in production and remained in the sample, display item, or gift stage and have not been transformed into commodities. There are 29 projects in this case: together with the 77 uncompleted projects, they represent 56.4 percent of projects that should have been applied and promoted.

We have made preliminary statistical analysis of the project completion and technological result application and promotion by the four different research units in large enterprises, medium and small enterprises, research organizations and institutes of higher learning. Analysis results show that, as far as applied research and development research projects are concerned, medium and small enterprises have the best record for completing research projects, scientific research organizations are second, large enterprises are next and institutes of higher learning come in last. This indicates that medium and small enterprises have the highest motivation to gain production, quality, profit and labor production rate from science and technology. In the area of promoting result application, large enterprises are most successful, research organizations come in second, followed by medium and small enterprises and institutes of higher learning again come in last. This indicates that large enterprises have the strongest technological force, the widest sources of capital and the best condition for promoting technological results. It should be pointed out that a very limited number of projects were surveyed and statistical significance may now show up, but statistical results for a specific case are still of reference value.

The survey showed a large effect of the "leftist" thought on the health development of local scientific and technological enterprise. Elimination of the "leftist" influence is therefore a prerequisite for properly formulating the development plan of local science and technology. The survey report conveyed the following important revelations.

1. In choosing local scientific research topics we must consider the specific need and feasibility of the local economy and society development and choose research subjects closely related to the actual production of the area. Research of production technologies that are widely used and have a bread impact should be strengthened in the various departments of the national economy. Plants and mines should be used as the experimental bases to encourage and institute collaboration between research organizations and institutes of higher learning and the plants and mines. Current shortages in research manpower, material and funds should be compensated by developing cooperation and the advantages of individual units. We should promote early and fast results and quickly promote the application of technological results in plant and mine enterprises to obtain prominent economic benefits. For example, in the development of sequential controller, the research was based on the actual production and a composite technological and economic target was properly proposed. Medium and small scale MOS integrated circuits give the product advantages such as high degree of integration, simple in structure, small in volume, light weight, low power consumption, and low cost, so that medium and small enterprises are able to afford and can easily use and maintain the product. In addition, anti-interference measures were incorporated in the design, the product performance is stable and reliable. It provided favorable conditions for promoting sequential control technology in industrial production and for achieving single machine automatic production and small scale assembly line.

Conversely, when research topics were chosen not on the basis of actual production, incompatable with the research ability of the unit and only blindly after sophistication and following the fad, nothing would be accomplished. A typical example is the development of the sugarcane harvester. This is a difficult task, but it was assigned to a county farm machinery plant for development. The plant had only a few technicians with a secondary vocational school education and a weak technical base, although 100,000 yuan were invested, not even a prototype was developed in 8 years. In those years, more than 50 agriculture machinery research topics were organized in 20 to 30 locations in the area and spent 1 million yuan. Although some research prototypes were made, most of them were not mass produced because they were too far removed from the actual needs of agricultural production. A few of the farm machinery that were put into production did not sell well and there was no popularized application to speak of. Another example is the automatic pork processing line and the electronic scale acquired by a meat processing plant, the automatic pork processing line was never put in operation and just sat on the sideline. These lessons are hard to forget.

2. In choosing the topics for local scientific research, we should pay attention to the technological sophistication and economic sensibility as well as social feasibility. The choice should benefit employment and standard of living improvement and should not cause environmental pollution and ecological disruption. That is to say, scientific prediction and technical economic arguments must be considered in formulating a local science and technology development plan in order to avoid choosing the research topics blindly. A hydraulic pressure component plant began to develop a "new" gear pump in 1976 without carefully gathering and studying relevant technical information; after working on the development for 3 years, it dawned on them that the product they tried

to develop has already been phased out by others. Another example is the development of small generators using aluminum to substitute for copper. Having conducted no economic analysis, not understanding the actual situation of domestic resources and not following the correct technical policy, the project began in ignorance and the prototype produced was a pile of junk. Then there was the project of producing potassium fertilizer from potash feldspar. The project made use of local resource but did not analyze the economy carefully. When the product was transported to the nearest town, it cost more to transport the product than the sale price, the product did not sell, the enterprise could not operate and was forced to close down the entire facility purchased with the three-category expenditure and had to switch to produce other products. A further example is the production of a new small killing agent to eliminate schistosomiasis from south China. This new drug can effectively kill the snails but it also poisons fish and other aquatic creatures and produces ecological damage, as a result, industrial production cannot be arranged. The examples go on and on.

3. Local science and technology development plans should include two parts: major research projects and the promotion of research results. Scientific research management systems must be perfected to ensure the basic conditions for scientific research and effective measures must be taken to strengthen the promotion of the application of research results. Under socialism a common feature shared by everything is planning. The formulation of a research plan is a strong guarantee for the development of the science enterprise. Of course, when we emphasize planning we should also adjust the planning with economic means.

In the survey we found many research projects that are promising and valuable. These projects should be given high priority for inclusion in the local research plan and should be guaranteed for necessary expenditure. Otherwise, without sufficient funding and the necessary facility and equipment, these projects would have to fold in mid-course and good opportunities would be missed and there would be avoidable losses. For example, the research of producing polyhydric alcohol by hydrogen glucolysis opened up an avenue for producing Shan-li-chun with noncrop material and satisfactorily solved the problem of general use of surplus syrup in sugar mills. After the preliminary tests were appraised in July 1977, adjacent provinces were ready to introduce this research result, but the research unit could not solve the expense problem for intermediate testing and the preliminary result has therefore failed to pan out.

The reason that research results were not promoted and applied is largely due to the lack of a unified special management organization and the absence of a detailed practical plan and because specific coordination measures were not taken. Especially the departments in charge of material, price, commerce, bank and tax did not provide the necessary help and support for the promotion of research results and the experimental manufacture of new products.

After the state science and technology commission made the suggestion in February 1980 that agriculture research results should be promoted with local, time and personnel factors taken into account, a local science committee

made use of science and technology three-category funds and organized the technological force, promoted agricultural technological results in several communes and increased production in these communes even with relatively serious natural disaster and when many other places suffered decreases in production. For example, the rice production of one commune increased by 2.82 million jin compared with the previous year and each member had an average income increase of 39 yuan. This is a strong proof that when research results beneficial for production development and standard of living improvement are included in the promotion plan and given funding assurance, they can be rapidly promoted and applied and economic benefits can be derived from them. This is true for the promotion of agricultural technological results, and it is also true for the promotion of technological results in industry, communication, finance and trade professions.

Today a number of good ideas have been proposed regarding the protection of technology and the transfer of technology with compensation. But in local areas, there are few special research organizations, the technological base is weak and research facilities are unavailable, only very limited research topics can be undertaken by local areas. Research results sold by local research organizations, even combined with those sold by departments and commissions of the central government, are only drops in the bucket for the local construction of the national economy. The important thing is to formulate economic policies and measures that encourage the plant and mine enterprises to conduct technological development and promotion, because a great number of research projects are carried out by plant and mine enterprises and projects receiving awards in the national science conference and local technology awards are also mostly conducted by plants and mines. Therefore, local finance departments should sponsor plant and mine enterprises to promote their own research results or the transfer of research results from other units. This funding should be included in the local science and technology development plan and other avenues of resources such as "science and technology development foundation," "technological improvement foundation," "capital construction investment," "self-raised capital" and "loan for technological measure" should also be coordinated to create the necessary conditions. The approach of "if it doesn't work, make it work" probably would not succeed. For example, an oil and fat chemical plant successfully produced cocoa fat substitute with hydrogenated cotton seed oil which could completely replace imported cocoa fat and save 10 million yuan per year. It solved a major technological problem in the production of chocolate foodstuff in China and could not meet the market demand. But this plant could not get the support of the pertinent departments for funds to add facility and for the supply of the cotton seed oil, as a result, a promotion project with great potential has been in limbo for a long time.

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IMPORTANCE OF DEVELOPMENT OF RESEARCH INSTRUMENTS VIEWED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 50-53

[Article by Zhou Li [6392 7812] of the Chinese Academy of Sciences' Space Center: "Attach Importance to Problems in Developing Scientific Research Instruments"]

[Text] In the history of the world's modern science development, it takes three conditions to achieve scientific and technological modernization within a short period of time, namely, a certain number of high quality scientists, advanced experimental facility and scientific management method. These are the three essential elements in developing research. In addition, policy, management system and the development direction of technology also play important role under certain conditions. In this article, we restrict our discussion to laboratory construction and ways to create sound experimental facilities.

The Importance of Improving Laboratory Facilities

In the microscopic world the subject of study in modern science has reached the interior of "elementary particles" and the ultrafine structure of material. Macroscopically, the world has extended over tens of billions of light-years of space. All these require constant renewal and improvement of laboratory facilities. In scientific research, measurement is an important method to the understanding of nature by combining theory and experiment and it is a procedure in which scientific research and technology are intimately combined. Through measurement, we can give qualitative and quantitative understanding and a concept of natural phenomena. The higher the measurement precision, the greater the probability of correctly revealing the laws of nature and the greater the ability to modify nature. Therefore, a nation's scientific level may be evaluated by the precision of its measurement standard and the technological performance of its measurement facility. Measurement helps the development of science and technology and the development of science and technology in turn promotes the improvement in measurement technology. Scientific research and measurement are complementary and inseparable and together they form an organic feedback loop.

The history of scientific development has shown that good experimental facility allows experimental work to open up, shortens the time of experiment, speeds up research progress and leads to prominent results. Examples are numerous. The invention of the telescope made possible the discovery of sun spots and the 28-day period of self-rotation, the numerous star clusters making up the galaxies and the rough surface of the moon. The use of the microscope advanced the development of cell biology and proved that protoplasma and cell, the structural components of all organic bodies, are the lowest level independent living organisms, verified the existence of blood capillaries which connect the artery and the vein, discovered the world of bacteria and made invaluable progresses in bacteriology, anatomy, medicine, biology, chemistry and physics.

In the last decade, technological methods in the world have been widely improved whether the technologies are for the analysis of the interior of the atomic nucleus or for the exploration of the outer reaches of the solar system; whether in the analysis of material structure or the material composition. Most of the technologies make use of computers for system control or data processing. Computers have not only reduced the labor of the operators but also accelerated the progress of the experiment. For example, a computer controlled radio telescope has discovered more than 30,000 radio sources in the universe, observed stars 10 billion light-years away, and discovered the spectra of intergalactic organic molecules and the 3°K microwave background radiation. These discoveries have given high energy physics research and the study of the origin of life a tremendous boost. Conversely, the loss caused by inaccurate measurement can also be shocking. For example, due to inaccurate field strength measurement, the gain of an expensive antenna in the United States has to be increased specifically for the measurement error, an increase of 1 dB of gain in each antenna caused an added expense of $50,000.

In short, modernization of science and technology must be backed by a modern measurement facility. In order to obtain high quality major breakthroughs in research, one must have advanced measurement equipment. Normally, measurement equipment is an important "front man" in scientific research. Naturally scientific research itself is also continuously solving problems in measurement and providing new measurement equipments. In the rapid development of science and technology, newer and more complex disciplines and branches of science and technology will undoubtedly emerge and the development and production of newer and more advanced measurement equipment must also follow suit; otherwise, the modernization of science and technology will be hampered.

Characteristics of Equipments Used in Research

1. The making of equipment goes from simple to complex and from crude to sophisticated. In the process of research experiment, researchers begin by building some simple instruments themselves and as the investigation develops some of the simple equipments are phased out when the research subject concludes and some of them are improved and perfected gradually and evolve into a new model of instruments along with research development. For instance, some of the equipments become high efficiency purification and extraction instruments, some turn into high speed separation equipments, some evolve into

complete synthesizing setups and others become various electronic instruments that measure the results of the research.

2. As technical science develops, so does equipment used in scientific research. Electronics, computers, low temperature equipment, optics, and automation are just a few examples of the technologies. Scientific instruments today have become an integration of many technologies and are made up of different equipments. Development of technical sciences directly affects the development of scientific equipment. For example, in the field of electronic measurement alone, the technology has reached the fourth generation or the "electronic technology era." Measurement techniques and experimental equipment are unprecedented in terms of method, variety and scope of application. With today's highest standard electronic equipment, the smallest quantity measurable is 10^{-19} Farad, the largest quantity measurable is 10^{18} Ohm, the lowest frequency measurable is 0.000001 Hertz, the highest frequency measurable is 148 Gigahertz. The highest accuracy in frequency measurement is 1×10^{-10} and the highest stability is 10^{-16}/sec. The problems of background noise must be overcome in achieving these extremes in measurement.

After several decades of development and change, electronic instruments have gone through vacuum tubes and transistors and are now made of integrated circuits, which are the basis for today's miniaturization, digitization and the solid state approach. Development continues toward automation, integration, digitization, high precision, multiple function and wide range (large dynamic range). Scientific instrument and equipment cannot get away from electronic instrument and technology, the precision and stability of scientific equipment are also affected by electronic instruments.

3. The technical specifications of measurement instruments used in scientific research should be one or two orders of magnitudes higher than production equipments. This is because quantities to be measured in experiments are mostly unknowns of an exploratory nature. In this sense, there will be no results and no achievements without measurement and analysis. New developments, discoveries and techniques always pose new technical specification and definition. Moreover, because of the exploratory nature of scientific research, parameters measured in the investigation process often need support from other measurements. Measurement method and requirement in scientific research also vary greatly. Therefore, the performance of experimental equipments is expected to be higher than that of production equipments.

4. A scientific instrument should have short measurement time and high measurement speed. We all know that the shorter the experiment period, the faster the research progress. Particularly in repetitious and continuous experiments, it is even more important to obtain measurement and analysis results as rapidly as possible. In today's developed nations, computers are widely used in operation control and data processing to speed up the progress of experiment and shorten the experiment period. When researchers finish their work and go home, the experiment and measurement do not stop. Thus, experiments requiring several years in the past can now be computed in only a few days or even a few hours.

Current Problems in Developing and Producing Research Instruments and Recommendations

1. Among thousands of instruments and equipment , which instruments should we concentrate our effort to develop? Instruments used in scientific research can be divided into three types. The first type is large-scale experimental equipment. Whether for special use or for general use, the development of large experimental equipments involves complex technology, large investment and long building time. In foreign countries this is usually managed by system engineering methods. These types of projects are generally priority engineering projects of some units. As long as they are well organized and carried out scientifically according to objective laws, they can be completed on schedule. The second types are general instruments and meters. They are used not only in scientific research but also in industrial and agricultural production process. Institutes of industrial departments have already achieved outstanding results in improving these general purpose instruments and meters. The third type is relatively special purpose instruments used for structural analysis and composition analysis in research. This type of instrument should be given priority in development and manufacture. It includes the seven major instruments (optical spectrograph, chromatograph, mass spectrometer, energy spectrograph, nuclear magnetic resonance spectrometer, and electron optics and ion optics equipment) widely used in chemistry, biology, earth science, oceanography, physics, new material and new device research. These equipments are special instruments to some departments in industrial and agricultural production but they are general purpose equipments for scientific research. One more difference is that in scientific research the measurement ability of an instrument should improve continuously along with the development of research and the instruments are required to have high precision, wide range, high speed and multiple function. Hence we should concentrate on the development and mass production of these high quality and stable instruments.

2. Over the years we have obtained good results in organizing the development and manufacture of research equipments. But in the area of management, development and production, we have always been relatively weak and lacked management personnel, overall survey systematic analysis and effective measure. As a result, we have not mastered the trend of development of laboratory equipments, the intrinsic rules of development production, and the current status of the technical force. We do have some statistics but we have not identified and solved the problems using these statistics. We should now draft some qualified comrades and organize a special unit for the development and production of scientific instruments, conduct extensive survey both in China and abroad and identify some typical problems, then we can organize and implement projects to develop and produce scientific research instruments, coordinate various technical problems in this development effort, formulate specific technical plans and get this work underway.

3. Strengthen technical ranks. In our learning of advanced foreign technology, some comrades have the wrong idea that we can successfully copy any foreign instrument that we buy. But things are not that simple, because modern scientific instruments are not the simple electrical and mechanical equipments of the 1930's, they are instead composite instruments using a

variety of complex technologies. Without accumulated technical knowledge and development in applied technology based on applied research, imported technology cannot be "licked." For example, Changchun Institute of Applied Chemistry and Hubei Institute of Physics assumed the responsibility of developing 100 MHz NMR spectrometer. At that time China had already imported about ten 90-100 MHz NMR spectrometers but many other institutes were not able to take on the job because they lacked the technical ability in this area. The two institutes in Changchun and Hubei, based on their experience in magnet characterization, machining technique and spectrometer from developing 60 MHz NMR spectrometer, conducted dozens of tests and improvements and obtained good results after 5 years of hard work. This experience has proved that, without a professional, technical rank and accumulated knowledge on applied technical research, it would be very difficult to copy advanced imported instruments. We therefore recommend a serious effort in organizing a technical team in this area. We should improve not only the technical staff of special instrument plants but also the technical staff of research institutes and let them develop their initiativeness and specialty. Changchun Institute of Applied Chemistry and Hubei Institute of Physics are experienced in developing NMR spectrometer, Dalian Institute of Biology, Shanghai Institute of Biochemistry and Lanzhou Institute of Chemistry have formed a formidable team in chromatograph development, Changchun Institute of Optics and Fine Mechanics and Shanghai Institute of Technical Physics have trained a technical team on optical spectrograph, Anhui Institute of Optics and Fine Mechanics, Shanghai Institute of Optics and Fine Mechanics and Shanghai Institute of Electronics are still far ahead in laser development. As long as we consciously organize the technical force of these institutes, we will not only digest the imported instruments faster but also make innovations in modeling these instruments.

4. Solve the problems existing among the technical personnel and motivate their activity. Some comrades in the present system of research institutes are discontented with their technical jobs and feel that the organization has not given adequate attention to technical work. Moreover, the pay of technical personnel is low whereas in foreign countries the salary of technical staff is often higher than that of researchers. If this problem were not solved, it would certainly affect the motivation of many people.

The foundation of our scientific and technological modernization must be placed in China. In the area of foreign technology we should only bring in model instruments and patents, the larger number of instruments must be built with our own hands. In the hands of technical personnel, researchers' new ideas are turned into new experimental instruments. In the process of building up a laboratory, both copying new equipments and improving old equipment rely on the technical staff. It is therefore particularly important to formulate policies governing the technical staff and motivating the wide ranks of engineering technical personnel. In addition, we recommend that the number of technical personnel in delegations visiting foreign countries should be appropriately increased because "they can figure out new things and technologies just by seeing them"* and produce instant effect. Finally, frequent special technical meetings and experience exchange will also promote the development of technology.

*Note: Premier Zhou's comment on a report by the Ministry of Foreign Affairs and the Ministry of Foreign Trade regarding the exchange of observation groups between China and Britain.

5. In the development of laboratory equipment, we should go beyond the boundary of discipline and have unified planning and organization. It is advantageous to improve the system according to academic discipline, but in building up a laboratory it is better to have unified organization. For example, high efficiency chromatograph is a necessary analysis tool in biology, earth science, and chemistry; if the organization is not unified there will invariably be repetitions and wastes. On the other hand, if the technical pool is organized and equipment developments are assigned to various institutes according to their natural division and based on the specialties of each institute, then not only the institutes can develop their technical capability but the components developed will be characteristic of the institute and the equipment built will be more stable. Besides, when each academic discipline organizes their own equipment development effort, then, because of the non-uniform technical capability there will be great differences in strength.

6. Develop the potential of institutes and plants to form a base for intermediate experimental production of new products. After scientific instruments are developed, they often fail to be popularized. There are a number of reasons including instability of electronic components, technical problems in instrument function, problems in manufacture technology and limited usefulness of the instruments. At the present there are four problems in instrument development urgently awaiting solutions.

(1) Make the product quality stable and reliable and make the technology mature. (2) Based on the current development capability, draw on advanced foreign technology and improve the ability. (3) Gradually use computers for procedure control and automatic data processing in all the instruments developed. (4) Combine different instruments and equipments to form general purpose analysis and test equipments.

Among these four problems, the key item is the first one. To solve the quality and manufacture technology problem, foreign countries often invest to build an intermediate experimental production facility. In China, it is difficult to come up with more funds, but the manufacture quantity of plants is very uneven, some plants have great potential for development and can be organized to assume the duty of intermediate experimental production of certain new products. When we organize this effort, we must be patient and do it carefully and thoroughly. After the situation is well understood, test runs can be made in qualified plants and unqualified plants can be organized later after they gain some experience. If we do this, we will on the one hand equilibrate the production of plants and on the other hand accomplish the job of intermediate experimental production. This approach not only will cultivate technical personnel but will also save the state a great amount of investment. It will solve the product popularization problem and the laboratory equipment problem at the same time.

In the space above we have only brought up some issues. The actual implementation would be impossible without a system of tried and true methods and a leadership group that is familiar with the profession and has a strong ability for organization.

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LAWS OF DEVELOPMENT OF NATURAL SCIENCES DISCUSSED

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[Article by Luan Zaochun [2940 2483 2504] of the Heilongjiang Academy of Social Sciences: "Laws on Development of the Natural Sciences"]

[Text] All things in the world follow certain objective laws in their development, natural sciences are no exceptions. The so-called laws are recurrent relations in the essence of events. Our task is to explore the objective laws of development in the history of natural sciences and use these laws to guide our future work.

Science is a system of theoretical knowledge and natural sciences reflect the objective laws of nature. The development and evolution of natural sciences is invariably dictated by the objective laws of nature and the laws of theoretical knowledge development and progress.

Science is also a product of history and is produced under a certain historical background and social condition. Scientific activity is an important social activity and its development and change are always influenced and constrained by social factors such as economy, politics, military and tradition. The development in science is therefore controlled by the laws of social development.

We therefore examine the laws of development of the natural sciences from the "knowledge history" and "social history" aspects of the development in natural sciences and seek the laws of development of the natural sciences from the dialectic relationship between "knowledge history" and "social history."

Today the viewpoints regarding the laws of development of the natural sciences are very inconsistent, some people even deny the existence of such laws, and there has not been a unified understanding. In this paper the author extracts the reasonable portions of different views and propose some bold and tentative arguments based on the fundamental viewpoint discussed above for the purpose of discussion and study. I believe the development of the natural sciences obeys the following laws.

I. The Law of Proper Sequence and Steady Progress in the Development of Natural Sciences

The enormous system of natural sciences is the result of gradual development in the course of several thousand years of human history. The accumulative, gradual, continuous and sequential nature of scientific knowledge exhibits a law of proper sequence and steady progress in its development. The development of scientific knowledge is gradually from less to more, from simple to complex, from low to high, from diffuse to systematic and from singular to compound.

Science is a system of knowledge of reason. Different points of view and schools of thought are formed in exploring and seeking the answers to questions such as how is the knowledge of reason produced? How does the knowledge of reason develop and evolve? How are disciplines of science formed from these knowledge of reason? How do the different fields evolve and develop? And what relationships exist between different fields of science? The Marxist theory of knowledge provided answers to these questions in principle and it is the theoretical basis of our understanding of the development laws of natural sciences. Some Western natural philosophers have also proposed many different points of view and we should critically absorb the sensible portions of them.

In the West there has been a inductionism viewpoint of science regarding the generation of scientific theory. This viewpoint was first advocated by British philosopher Francis Bacon, who proposed that experience is the foundation of all science, and scientific theory should be derived from the observation of facts and the inductive method. Bacon's viewpoint was developed by Muller and Spencer and gradually formed the current induction philosophy in the 20th century. From the induction viewpoint science is the knowledge derived from factual experience and verified by experience. There are two basic principles in inductionism: (1) Science begins with observation and observation provides a reliable foundation on which scientific knowledge is built.[1] (2) Scientific knowledge is derived from observation and description with the aid of inductive principles. Based on these principles, the certain conclusion is that science development is accumulative and progresses steadily. The model of the inductive view of science is as follows:

Observation —induction→ principles and theory —deduction→ interpretation and prediction

The desirable feature of inductionism is that it emphasized the important role of observation and experience in the generation of scientific knowledge and proposed an accumulative and gradual development model for science. But inductionism has its shortcomings too, it overemphasized the function of observation as observation may be erroneous and mere observation cannot guarantee the correctness of all the theories obtained. Inductionism has its limitations also, and merely relying on inductive method cannot guarantee correct conclusions deduced from factual observations. The elevation from perceptual knowledge to rational knowledge not only requires many different methods of

logical thought (not only induction) but also needs the repetitive process of "cognition--experience--recognition--reexperience."

We should not accept the entire inductionism; instead, we accept only the rational part of inductionism. In the meantime, I am also against totally abandoning the induction philosophy. Induction has its place in science history and the inductive method is a desirable method of logic thought. Newton claimed that his laws of motion were not speculation, they were truthful description of the facts and they were built using the induction method.[2]

The overall trend in scientific development is accumulation and steady progress, but in the long history of science, the rate of progress is not uniform, the development is sometimes fast and sometimes slow. In the development of modern science and technology, there is an evident trend of accelerated development. Scienologists Bernard and Price have proposed a theory of exponential growth of science known as the law of "accelerated development of science." Scientists analyzed the quantitative change of scientific investment, science and technology staff, scientific publications and papers and major discoveries in the development of history of modern science and discovered each of the above doubles in 10 ~ 15 years.[3] Although this "law" correctly pointed out the development trend of modern science, the "law" does not hold. A law is a recurrent relation in the essence of the events, the law of exponential growth of scientific development cannot hold since it is not recurrent. If calculations were made according to this exponential law, they lead to the absurd conclusion that before long the number of scientists would equal the total population of man. Hence this law does not hold true. It merely reflects the development speed of science in a brief historical period.

Scientific development is not only manifest as accumulative and progressive, it also shows rigorous inheritance and orderliness. The tower of science was built with the efforts of generation after generation, modern man can continue to add bricks to the tower of science only on the basis of mastering the scientific achievements of the previous generations. The first thing a scientist does is to inherit and master the scientific achievements of previous generations and contemporaries by learning, otherwise he cannot accomplish new scientific achievement. Scientific research activity is a process of using the "known" in exploring the "unknown." Numerous examples in science history attest to this. For example, the three laws of Newtonian mechanics are entirely built on the achievements of previous scientists. It would have been impossible for Newton to propose his great theory in 1687 without the three laws of planetary motion summarized by Kepler and many dissertations on the law of gravity by scientists of that era (1645-1680) (for example, Hooke had fought Newton for the credit of discovering the law of universal gravitation) and Picard's accurate determination of the earth's radius in 1671. Newton's remark that he "stood on the shoulders of giants" is totally consistent with the objective law of development of events, induction and integration is itself one kind of creativity. If there were no Newton, there would have been other scientists accomplishing his discoveries because the time and condition were exactly right for the discovery of the three laws of motion and the law of universal gravitation, Newton was merely the "favorite son of the era."

The orderliness of science development manifests itself in the sequential and limiting nature of science discoveries. In the 17th century when the understanding of the microscopic world was still a void, Newton investigated the laws of motion in the macroscopic world and Newton could not have discovered quantum mechanics and relativity. Only after Dalton's atomic theory and Planck's quantum theory did Einstein discover relativity. If the laws of motion of the solar system were not understood, it would have been impossible to discover the laws of motion in the Milky Way. If the structure of atoms were not understood, it would have been impossible to discover the structure of the atomic nucleus. Only after the nuclear structure is understood, then it is possible to probe into a deeper level--the mysteries of the elementary particle structure and establish and develop high energy physics. Material movement in nature has a certain sequence and the development of scientific theory progresses gradually according to the sequence of material movement. Theories of the next level can be developed only by inheriting theories of the previous level. At the time of Einstein, there was little understanding of the structures on the elementary particle level and as a result his attempt to explore the unified field theory did not succeed. Even a great scientists like Einstein working for 30 years could not violate the objective law and achieve results before its time.

The accumulative, progressive, inheritive and sequential nature of science development constitutes the law of proper sequence and steady progress in science development. This law provides guidance in our effort of scientific research, technological improvement and science education. In our scientific research effort if we hasten to tackle problems in frontier science and impatiently set out for some high scientific goal before we can even handle the results of previous scientists and understand the law of material movement on a previous level, we shall only waste our time and be doomed to fail. We should learn from Newton to stand on the shoulders of giants, integrate the accumulated scientific achievements and then try for a breakthrough and obtain major results within a short term.

In development research we often see cases where the fundamental principles and basic components are not yet worked out but great effort and time are spent in developing the whole system without any success. "Haste makes waste," haven't we seen enough lessons?

We know the proper sequence and steady progress in learning very well; without a background of introductory mathematics, it would be futile to study advanced mathematics. For the same reason this objective law must also be followed in science research and technological creativity. We should humbly inherit, accumulate slowly and gradually develop; under no circumstances can this be scolded as "crawling."

II. The Law of Revolution in the Development of Natural Sciences

In the development process of natural science the progress is not always steady and gradual and it is not always a quantitative accumulation; instead, sudden changes and qualitative jumps in science theory occur in certain periods and we have a scientific revolution.

There are three representative views on the interpretation of scientific revolution, they are the counter proof of [Bopu], the revolutionary theory of Cohen and the scientific concept revolution theory of Einstein.

In 1959 Austrian philosopher [Bopu] proposed the viewpoint of counter proof. He objects to logic justification and believes that results of observation and experimentation cannot prove a certain theory to be true. On the contrary, results from observation and experimentation can prove a certain theory to be false. In other words, a theory cannot be proved true, it can only be proved false. He believes that science does not begin with observation but with a problem. Hypotheses to a specific question are first proposed, attempts are then made to prove them wrong, theories proven to be false must be discarded without mercy. He views the development of science as a continuous process of theories being proved false, or, it may be called a theory of "continuous revolution." His model of scientific development is as follows:

Problem ⟶Hypotheses ⟶Counterproof⟶New problem

The desirable feature of his theory is the emphasis on problems. Discovering a problem and raising a question is a sign of progress and a prerequisite for scientific discovery. Many famous scientists have posed questions and speculations which led to many important discoveries. Two thousand years ago, the great Chinese poet Qu Yuan raised 172 questions in one breath in his book; some of his questions are still unanswered. In 1978 an "Encyclopedia for the Unknown World" was published in America and Britain, the editors requested 56 famous scientists to list 51 special topics in 6 fundamental disciplines and give a general introduction to the phenomena unexplained by present scientific understanding or with a controversial interpretation. This book shall no doubt have a guiding effect on science research.

The shortcoming of [Bopu] theory is that he totally denies the role of experience in the confirmation of a theory and he totally denies the thought function of induction. Any theory can only be a general rule, there are always special cases in generality, totally disclaiming a theory because one special case is illogical. There are always stable periods in the development of science theory, there are also internal connections and inheritance among the various theories. The development of scientific theory is not like the process described by him in which scientific theories are constantly being proved wrong and continuously being discarded.

American scientists and philosopher Cohen believes that neither the induction theory nor the counter proof theory are consistent with historical facts, in his book "The Structure of Science Revolution" published in 1970 Cohen proposed a new viewpoint of science revolution. Cohen believes that scientific development should not be viewed as a simple accumulation of knowledge but one should also look at the qualitative change of science theories. Cohen stresses the role of science revolution, his model of scientific development is as follows

Prescience ⟶Conventional Science ⟶Crisis⟶ Revolution ⟶New Conventional Science .....

Prescience refers to the period of controversy before a systematic theory is formed, conventional science refers to the period after a systematic theory is formed. Conventional science is then put to actual practice and used in problem solving. Conventional science continues to improve until it encounters more and more difficult problems and a crisis in theory arises. Crises finally lead to a revolution in which the old theory is replaced by an entirely new theory, the new theory then enters its conventional science stage followed by new quantitative changes until new crises appear.

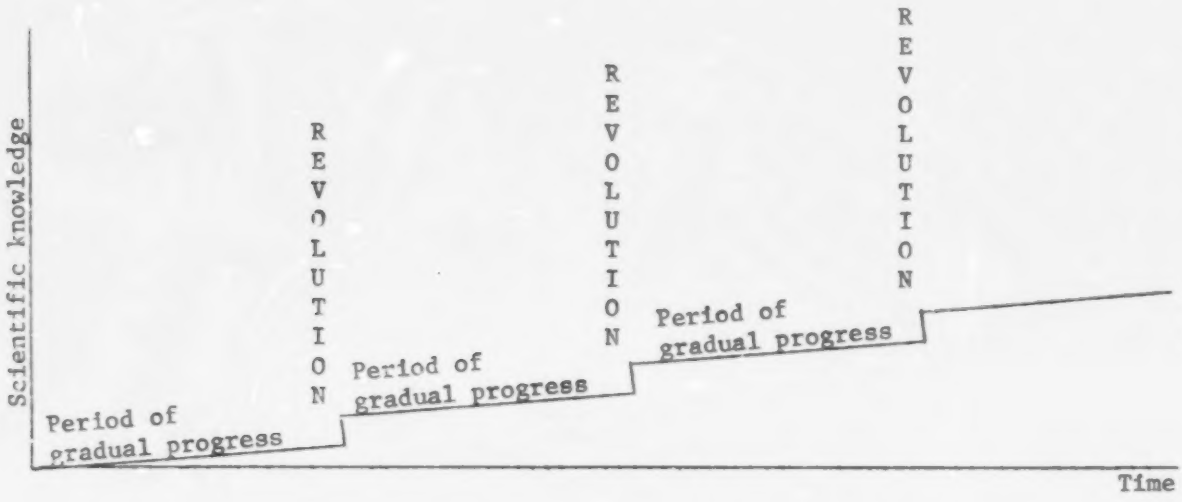
Cohen's emphasis on the qualitative change in the development of science theory is correct and this is a merit of his theory. However, his theory also has serious inadequacies. He overlooked the inheritance nature of new theory and the old theory and he overemphasized the incompatibility of the two theories before and after the revolution. In addition he denied that the goal of scientific advancement is the truth, he denied the existence of objective truth and disclaimed the connection between relative truth and absolute truth.

Einstein has made some profound discussion on science revolution. He proposed the idea that the history of scientific development is a history of scientific concept evolution. He believed that "fundamental concept plays the principal role in establishing a physics theory. Physics texts are full of mathematical formula but all the theories in physics originate from thought and idea, not equations." He also believed that people use mathematical formula to express the theory quantitatively only after the concepts are established. He thinks that "these fundamental ideas and assumptions which cannot be further simplified logically" constitute the "fundamental concepts" and "scientific concepts" which become the basic component of theory and play the role of an "axiomatic foundation." In a science revolution, the past experience and knowledge are not changed, nor are they discarded, only the criteria in understanding this knowledge and the theoretical framework of the knowledge change. In other words, only the fundamental concepts of science change.[4]

Einstein has not only emphasized the revolutionary nature of science development, he did not overlook the accumulative nature either, he put the two together organically. He revolutionalized physics by establishing a theory that replaces Newton's theory. Einstein's theory not only can pass the tests Newton's theory failed to pass and some further tests[2] transcending the realm of validity of Newton's gravitational theory. Einstein's viewpoint is more consistent with the objective and correctly reflects the history of science.

The law of proper sequence and steady progress and the law of revolution in the development of natural science are completely in agreement with the fundamental law of quantitative change to qualitative change in materialistic dialectics and with the development history of natural sciences. By combining these two laws we have the following picture of natural science development. In the long course of history the progress of natural science is sequential and gradual, scientific knowledge is constantly accumulated and passed on from generation to generation. At some stage of the science development, revolutionary changes in science theory take place. New theories at a higher level are more correct and broader than old theories; they not only can explain facts explainable with the old theory and predict more. The emergence of a new theory causes

major changes in the old theory and is followed by a period of proliferation until a newer theory appears. This development style is similar to walking up the stairs on a gentle slope, one walks a stretch and goes up one step, walks another stretch and goes up another step. I therefore call the model of natura natural science development the "gradual stair model," as shown in the figure below



Looking at the history of science, the progress of various fields are not uniform, some fields develop faster than others and some slower. The faster developing fields promote and help the slow developing fields. This is especially true in modern science and technology where the trend is mutual overlapping and penetrating and various fields promote each other and progress together. A major theoretical breakthrough or scientific revolution in one field affects neighboring fields or even the entire field of natural science. A field with theoretical revolution in a certain historical period that had a major impact on related fields and the entire realm of natural science may be called "revolutionary science" or "advanced science." [Kai-de-luo-fu] of the Soviet Union has proposed an advanced science development principle. He pointed out on the basis of science history analysis that the first advanced science was mechanics which lasted 200 years, the second advanced science was in the fields of chemistry, physics and biology which lasted 100 years, the third advanced science was microscopic physics which lasted 50 years and the fourth advanced science is again in the fields which include control theory, chemistry, aerospace aviation, nolecular biology, genetic science and physical chemistry. He predicted in early 1970 that these fields will serve as leading sciences for 25 years and will be replaced by a single science, perhaps molecular biology. [Kai-de-luo-fu's] theory is doubtful, his claims that the changeover period of advanced science is decreased by one-half each time and that a single field and a group of fields alternate are only a crude analysis and not a principle. Extrapolation of his theory will lead to absurd conclusions and the frequent alternation will also negate the leading role. A group of sciences or a large

number of fields mentioned above cannot realize the role of leading. But [Kai-de-luo-fu's] concept about advanced science still has its merits.

In the development process of natural sciences it is normal to have a period of revolution in which important theoretical revolution in one field causes major changes in the original science theory system, but we have not discovered the period of these occurrences.

Guiding our scientific research with the law of revolution in the development of natural sciences means we must get our hands on "revolutionary science" or "advanced science" and give it high priority support so that the results can quickly be spread into other fields and play the full role of a leading science. If it is within our power, we should concentrate our force to tackle a field where major breakthroughs are possible (circumstance and opportunity permitting); if it is beyond our capability, then we should actively employ the revolutional results of others and quickly exploit the achievement in the science and technology field of China and obtain more results in a short term.

In the space above we have explored the laws of development of natural science from the intellectual history of science development. Now we shall explore the laws of natural science development from the social history.

III. The Law of Promoting Science Development by Production

Engel's answer to the question of how did science begin was: "From the very beginning the occurrence and development of science was determined by production." Production is the source and driving force of science. Production activity is the fundamental activity of a society. Science is the purification and consolidation of rich experience in production. Increase in productive force leads to the division of manual labor and intelligence labor and science is the production of intelligence labor. In ancient history production activity was largely agricultural and forestry production. Improvement of agricultural production experience produced agronomy, geometry, calendar and irrigation and water conservancy sciences closely related to agricultural production.

Productive force is the fundamental driving force for social development and the need for productive force development is the fundamental need of the society. Essential elements of productive force are labor, means of production and object of labor. To improve the productive force, the worker must know advanced production technique and advanced means of production, these two elements constitute an advanced production technology. "Necessity is the mother of invention." Development in productive force pushes forward production technology and causes a continuous generation of new techniques. The need to develop new technology in turn moves the scientific development. If the generation of ancient technology is largely due to experience then the creation of modern technology relies mainly on science. For example, the need to develop space technology moved forward the development of space science, aviation technology promoted the birth of aerodynamics, and computer technology also promoted the development of computer science and semiconductor physics.

Therefore, from the viewpoint of production pushing forward the development of science and technology, the law of development of natural science is as follows.

Production ——→ Technology ——→ Science

Great developments in production also cause great developments in technology and science. Major development in production technology not only provides more research funds for scientific study but also provides more advanced experimental equipment and facilities and the development speed of science will be accelerated.

Looking back in history, the development of modern science and technology is accompanied by major capitalistic production development. A commodity economy propels technological and scientific development. A high tide in production and construction occurred during the first 5-year plan in China, accompanied by an upsurge in science in 1956. After the downfall of the "gang of four," a high tide in construction of the four modernizations emerged in China accompanied by the blossoming of science in 1978.

On the other hand, when the production development is slow or when the production is halting or in a destruction period, development in science and technology will also be in a state of stagnation.

From the viewpoint that productive force is the major driving force for social development, production activity is the source and impetus of science and technology production. However, a reversible dialectic relationship also exists among production, technology and science, that is, science ——→ technology ——→ production, and science may be ahead of technology and production and promotes the development in production. Although such a dialectic relationship exists, the entire history shows that the source and impetus for producing science still follow the basic law of production ——→ technology ——→ science.

IV. The Law of Science Development Constraint Due to Social Changes

"Revolution is the locomotive that moves history forward." Revolutionary and progressive social changes promote the development of science and reactionary and backward social changes impede and disrupt science development.

In recent history the bourgeois revolution in Britain and France, the Civil War in the United States, Meiji Restoration in Japan and Xin Hai revolution in China are all bourgeois revolutions and have all defeated feudalism to a different extent and thereby promoted science and technology development in these countries. Modern science and technology is developed accompanied by bourgeois revolution and capitalistic production style.

The "May 4 Movement" in China unveiled the prelude to the new democratic revolution and raised the banners of "science" and "democracy," put forth "Mr S" and "Mr D," open war with ignorance and autocracy and played an active promotion role in China's scientific and technological development. The two big banners of the "May 4 Movement" are highly significant, science and democracy are twin

brothers, without democracy there is no science and without revolution there is no science. So the relationship between revolution, democracy and science is as follows.

Revolution ——→ Science

Democracy ——→ Science

Conversely, reationary social changes have great impeding and damaging effects on the development of science and technology. The modern history of China is sufficient proof. The disastrous effect of the Sino-Japanese War of 1894-95 awakened the Chinese people and a group of intellectuals vigorously advocated social changes. In the Wu Xu reform movement led by Emperior Guang Xu, China began to learn modern science and technology from the West. Although this was a reform movement, it also has social progress significance. But this reform movement encountered frenzied subversion by the gang of the empress, not only were the reformers beheaded, but all the advanced technologies were branded trickery in an encirclement and suppression, railroad tracks were torn down, loaded onto ships and thrown into the open sea, and science was feared like a plague.

The unprecedented "Cultural Revolution" conducted the greatest encirclement and suppression on science. Jiang Qing learned from the empress and went far beyond. She claimed "science is guilty," "the more knowledgable, the more reactionary," ignorance is "meritorious," "the more ignorant, the more progressive" and turning in a blank paper in exam is heroic." It can there-therefore be said that all counterrevolutionary social changes are anti-science. Authoritarianism can only produce ignorance and backwardness. Their relationships are:

Counterrevolutionary ——→ Antiscience

Authoritarianism ——→ Ignorance

FOOTNOTES

1. Qiu Renzong [6726 0088 1350], "Some Aspects of Western Science and Philosophy," 1979.

2. "Einstein's influence on my view of science--Interview with (Bopu), NATURAL SCIENCE PHILOSOPHY JOURNAL, 1980.3.

3. Bernard, "On the Road to Scienology," 1965.

4. Guan Shixu [7070 1102 4958], Jiang Zhenhuan [1203 2182 3883], and Wang Yan [3769 1484], "Science Revolution and Scientific Concept, 1980.7.

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IMPROVED SCIENCE RESEARCH MANAGEMENT ADVOCATED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 p 1

[Article by Qian Sanqiang [6929 0005 1730]: "Establishing a Chinese Style Management Science Based on the Objective Rules of Science Research Management"*]

[Text] Along with the progress and development of modern science and technology, science research management emerged as a branch of science. At the present time some comrades have not recognized fully and understood the important role of science research management and some people even flatly deny the scientific nature of research management; so far there has not been a unified view on some of the theoretical concepts of science research management. Nevertheless, everyone is eagerly hoping to improve our science research management and promote the modernization of science and technology in China, this is a shared feeling. So how should be go about improving the standard of research management?

Basically speaking, the most important task is to explore seriously and study the objective laws of science management and advance from perception to theory and truly understand the "reasons" behind them. Then we need to apply them in actual practice and continuously make improvement. In the past we have repeatedly stressed "less interference, more attention" in management, that is, in our science research management we should follow scientific methods and do things according to the laws of science in order to promote scientific development and produce results and talents. In the past some people are accustomed to the "I'll tell you what to do" type of management, this situation should be thoroughly changed and management should be studied, employed and developed as a science.

To a larger degree the standard of research management depends on the quality of management cadres. Some of our comrades have engaged in science management for many years, they are enthusiastic about science and have done a lot of work on their respective posts and accumulated a wealth of experience, they made

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*Excerpt from opening address given by Comrade Qian Sanqiang at the Chinese Academy of Sciences research management symposium on 17 August 1981.

many achievements in the history of building up the Chinese Academy of Sciences. But it should be realized that, along with the rapid development of modern science and technology, the requirement for research management is now increasingly high. It not only requires each management cadre to have the fundamental knowledge of a certain science discipline and be familiar with the characteristics and general rules of scientific and technological development, but also requires them to possess the knowledge and method of management science and be familiar with the policies of the party. The management cadres should also be good at organization and good at the use of theory to consolidate and improve work experience. Therefore, merely possessing general work experience and enthusiasm is far from adequate in meeting the demands of a constantly changing objective situation. Each of our science research management cadres must work hard to learn and to explore, constantly improving himself with new knowledge, reducing thoughtlessness and overcoming passiveness, and continue to contribute toward the management modernization of the Chinese Academy of Sciences.

Our research management should not only be characteristic of China but also be tied in to the actual situation of the academy. In the past few years we have gradually published considerable literature on foreign science management, this is a necessary step toward understanding the situation and broadening our viewpoint. However, our work and thought should not be limited by this literature and these concepts. The goal of our management science study is to solve our problems in China and the problem of our academy. Therefore we should neither adopt blindly the foreign experience nor should we reject them all. Whether we use them or not depends entirely on the actual situation. We should also advocate a spirit of innovation in research management. Only then can we solve the problems we are facing and propose our own theory and establish a Chinese style management science. I believe this is entirely achievable.

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TALK ON SCIENOLOGY, MANAGEMENT OF SCIENTIFIC RESEARCH

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese, Vol 4 No 1, Feb 82 pp 39-44, 38

[Article* by Qian Sanqiang [6929 0005 1730]

[Text] The national Scienology Theory Discussion Conference is closing today. This conference has been a good one. Everyone has engaged in enthusiastic discussion surrounding the central subject of the characteristics of and the trends in the development of modern science and technology.

The main purpose of the academic discussion meeting is to exchange ideas and viewpoints fully, to give mutual inspiration, to improve together, and to promote the continued forward development of scientific research. Therefore, different academic viewpoints and advocacies of different schools that have emerged during the course of scientific research should follow the guiding principle of letting a hundred flowers bloom and letting a hundred schools of thought contend. We must not forcefully demand unification of different viewpoints. Everyone can bring these problems home to study and study again and then discuss them. I believe, if we do so, we will surely have an even better Third National Scienology Academic Discussion Conference, and we will surely be able to continue to improve the theoretical level of our nation's research in scienology.

My contact with the work of scienology happened 3 years ago. At the time, scienology research had just begun in our nation. Some comrades mobilized me to listen to people's concerns. As a result, I became more and more interested. I thought, I have returned for 33 years now, what have I accomplished? Wasn't it management of scientific research and the participation in decision-making and organizing leadership! For more than 30 years, my work basically belonged to the work of scienology. But at the time, the term "scienology" did not exist. The work was carried out blindly, and I was only an unconscious scienology worker (laughter). Therefore, there was a lot of blindness

*This is an excerpt from the speech by Comrade Qian Sanqiang on 11 October 1981, at the closing ceremony of the National Science of Science Theory Discussion Conference. This article was edited by Comrade Jiang Guohua [5592 0948 5478]--Editor's note.

in the work. We did not think of this in the past. As China's Scienology research developed bit by bit, it has now found its niche (laughter), which is the realm of scienology. Although I specialize in physics and scientific technology, in the overall view, my true area of activity is still more closely related to scienology.

Theoretical research in scienology must contribute to building China's socialist modernization. This is what the party expects from us, this is what the state expects from us, and this is what the people expect from us. It is not because the term "scienology" has emerged abroad that we have to study it. The reason we want to strengthen research in this aspect is solely to solve China's actual problems and to explore the laws of development of our nation's science, in other words, to contribute to the building of our nation's modernization. On the other hand, only by combining it with the actual situation in the development of our nation's science can theoretical research in scienology have a root, establish itself and be creative.

Today, in our nation's modernization, there are many topics that are closely related to scienology research, for example: the relationship between science and technology and economic and social development, the relationship between science and technology, the relationship among basic research, applied research and technical development, etc. I hope that comrades handle these relationships well in selecting research topics and in determining the direction of research.

Below, I will offer some opinions from the point of view of summarizing my personal experience and scientific research management as an unconscious scienology worker to serve as a reference for comrades. Please correct me on the points you find inappropriate.

(I) Strengthening Applied Research and Technological Development Are the Keys To Realizing Modernization of Industry

China is a large socialist nation and also a developing nation that emerged from a semifeudal and semicolonial society without going through the stage of development of a capitalist society. Starting from Dr Sun Yat-sen and tracing backwards to the first half of the 19th century, progressive elements all wanted to begin working hard for the prosperity of the country, even though it was much later than Japan's Meiji Restoration. But because of many reasons, up to now, there is still a big gap between us and Japan in economic development and in science and technology. The government of the Manchu dynasty, especially during its later years, was very corrupt internally. Headed by the Empress Dowager, not even the opinions of the reformers were accepted, therefore, the situation forced the occurrence of the revolution of 1911. Our nation's history was different from that of Japan and also different from that of European nations.

Europe was the origin of modern natural science, or more precisely, natural science that expressed laws and relationships in quantities began in Europe. At the time, the creators included Galileo and others. Before this, or about 400 years ago, Europe was not more advanced than us. The many facts recorded

in the book "A History of Chinese Science and Technology" by British scholar Joseph Lee fully proved this point. But since the Renaissance, the gap gradually widened. The Renaissance was the germination of European capitalist culture and ideology. It was the product of the newborn capitalist production releations. It advocated humanism and opposed the feudal-religious thought centered around God. For example, Italians represented by Galileo freed themselves from many restrictions and achieved a high degree of personal development, and with the influence of the tradition of Greek culture, their thoughts turned to the discovery of the external world, and these were expressed in written descriptions and in mathematical relations of observed data. They manufactured things and developed things, and bit by bit, they formed a scientific research based mainly on the modern consciousness of observing phenomena. Finally, these were summarized in mathematical or logical and deductive scientific laws. Among the comrades here today, there are those who have studied physics in middle school. The most difficult concepts to understand when first studying physics are in the first chapter on mechanics. The most difficult concept in mechanics is acceleration. In ordinary life experiences, they are only forces and speed, and establishing the concept of acceleration is not easy at all. It was founded after many years of observation and study by Galileo. It was on the basis of astronomical observations, experiments and research by scientists of the generations before and after Galileo that Newton was able to finally summarize the findings into the famous "Newton's three laws of motion" and the "law of gravity" which in turn established a firm foundation for the various branches of science, engineering and technology. Later, the advent of the capitalist Industrial Revolution enabled capitalists to use natural science as a means to pursue wealth and riches. Science thus possessed the historical condition for a large-scale transformation directly into a productive force. From then on, a new era of a close combination between science and industry began. Science entered the realm of material production on a large scale, and this greatly improved the productive forces of the capitalist society. Conversely, the development of productive forces of the capitalist society also greatly hastened the historical progress of socialization of scientific labor. Therefore, I often said the emphasis of capitalist nations on science and technology has a long history of development as background for understanding. They have formed such a tradition. No matter how ignorant a capitalist is, at the end, he will learn to rely on scientific and technical experts. This is because without scientists, engineers, and skilled technical workers, and without carrying out industrial and scientific research and developmental studies, his products will lose their competitiveness and money will not be earned. Therefore, it is not that capitalists especially like scientific and technical experts, it is the result of the importance of "money" in the eyes of the capitalists. Holland, for example, utilized the achievements in the study of optics to push forward the development of the eyeglass manufacturing industry. We must realize that that was during the middle of the 17th century. At the time, manufacturing eyeglasses was as attractive as today's manufacturing of tape recorders. Many old people who could not see could solve the problem by wearing a pair of glasses. This produced a social effect. As a result, the capitalists became rich and at the same time optics developed in a more rapid way.

In recent times, the relationship between industrial development and scientific research became even closer. For example, everyone knows that German products are ingenious and sturdy and Japanese "Toyota" cars are sold everywhere but the German "Mercedes-Benz" is also widely used. This is because Germany has its historical tradition and a tradition of emphasizing applied research and developmental research in industrial development.

According to recollections of comrades who had worked in the materials research laboratory of Germany's Siemens Company at the beginning of the 1940's, Siemens' electric current meter that was sensitive to weak current was sold throughout the world. The key was the materials research laboratory at Siemens which developed high quality materials for each part of the current meter. The materials laboratory at the time, if described by today's classification of specialization, could be described as an entity combining the science of metallurgy, the science of metals, solid state physics, and material mechanics. The problems of technology and techniques proposed in production were all brought to the laboratory to be solved. According to these comrades, this was not only so at Siemens, almost all major German companies had a corresponding industrial research laboratory. This may be one important reason German industry has always remained in the leading position in the world. For example, America's Bell Telephone Company laboratories are also world famous. They have many scientists as talented as Langmuir. Most of the laboratories of American universities allow visitors, but the Bell Laboratories generally do not allow visitors. Their work is often several years ahead of present production needs. It is said that some companies are again advertising in the newspaper to hire researchers in the theory of particle physics at high salaries. This obviously is not for present needs.

They are preparing for several years later to use the research methods used in particle theory. They have such farsightedness and they want to make definite preparations in particle theory to explore new roads for future development. The purpose of mentioning this is to explain that after World War II, American capitalists have paid more and more attention to scientific research. At many places, small factories and small designing offices are established right next to universities to attract and to make it convenient for university professors and teachers to concurrently engage in applied research and development research.

Take Japan as an example. The universally accepted view is that Japan's industrial sector pays a lot of attention to applied sciences, applied research and technological development. When we were young, we looked down on Japanese goods. We said that Japanese goods were of poor quality and they broke soon after use. Yet Japanese products are now very different after 30 to 40 years of efforts. Japan may have relied on developing science and technology because of its natural historical conditions of having a small national territory, scarce resources, and a large population. Otherwise, its products would not have entered the world market, and it would not have been able to compete with developed nations. Therefore, it engages in more applications type scientific research. Of course, Japan's emphasis on scientific research did not begin after World War II. At the time, there was a magnetism expert who went to Germany to study. After he returned, he first began establishing

a metallurgical research institute. It was this research institute that formed the scientific and technical foundation for the later development of Japan's iron and steel industry. Many things, basic research and developmental research, technological processes and scientific technologies all came from this research institute. Therefore, today's industrial development in Japan is inseparable from this generation of old scientists who began emphasizing applied research and developmental research. Japan pays a lot of attention to basic sciences, therefore it has produced such remarkable scientists as Yugawa Hideki.

Generally speaking, capitalist nations all have a tradition of scientific research which started out for their benefit during its course of development. In industrial development, more emphasis is placed on the achievements of applied science and technology, and more emphasis is placed on applied research and development research that are suitable to and needed by the industries themselves.

In contrast, we lack actual understanding of the important function of science and technology in promoting national economic development. We do not have sufficient understanding of the importance of scientific research work in the industrial departments, and we have not truly placed it at the position it should enjoy. At the beginning of the 1950's, our nation accepted a group of projects with assistance from the Soviet Union. This has exerted a very important influence on our nation which now has a major industrial contribution. This should be fully affirmed. Now it seems that there are also some lessons which are worth summarizing. This, we did not fully understand the technological principles of some of these projects. Later, corresponding industrial applied research and developmental research did not follow up. As a result, you can build a factory and it can operate but when necessary, you can also investigate and copy, but, you will not be able to establish a creative ability. Without a creative ability, we will not be able to compete against others internationally. Therefore, since liberation, we have realized great achievements on the one hand, especially in the industrial sector. Its relatively important basic industries have already formed a complete system, but on the other hand, there are also deficiencies. nhat is, some industrial departments did not pay as much attention to applied research and developmental research as they should have, and they did not form the ability to carry out industrial and scientific research to promote the continued development of our nation's industry. Not possessing a strong ability to carry out industrial and scientific research is a major hindrance to our progress in modernization at present. This lesson is one which we should remember well.

Practice proves that in some industrial and scientific research, first of all, applied research and developmental research in basic industries is very important. This is the key to our nation's industrial modernization. Otherwise, the whole industry will not have the ability to climb slopes. It will lack self-reliance and the ability to establish itself as one of the world's advanced industries. Thus, we must overcome the obstacle posed by the idea of simply relying on imports without digestion and specifically copying others. We must also change the irrational way of providing funds only for importing equipment without providing funds needed to digest and improve the equipment.

Vice Chairman Deng pointed out in his talk at the science conference that the key to the four modernizations is scientific and technological modernization. This is right. I hope our industrial departments are determined to carry out effective and helpful measures to strengthen and improve the scientific research ability of our nation's industries.

(II) Whether It Is Basic Research or Applied Research, Both Must Be Strengthened

Recently, many people are again discussing the problem of planning our nation's scientific research. Some say that too much capital is being invested in basic research and it should be reduced. Others say that we are overly emphasizing applied research and this should be lessened. In fact, the two views are unilateral. In my view, whether it is basic research or applied research, we still cannot say that the investment is too much now. The investment is not enough. Some localities have invested far from enough. Therefore, I believe there should not be any debate and accusation. We should in turn strengthen organization, supplement each other, make overall arrangements, and develop them together. Of course, I am not saying that problems of imbalance in planning or distribution do not exist. This should be noted in actual work.

Everyone knows that what we call science is the system of knowledge about nature, society and thought. Studies in the history of science show that science originated from human production and actual needs in living. Its history is as long as man's own evolution. Therefore, science, especially natural science, by nature, is the knowledge of man's understanding of nature and man's efforts to rebuild nature. Basic scientific research is the leading edge of man's understanding of the objective laws of nature and also the starting point of exploring new technological areas. It can be easily seen that basic science is the cornerstone of modern scientific structure. Basic scientific research is the "generator" that discovers and invents ideas of modern science. The Swedish physical chemist Svante August Arrhenius said "Theory is the most important driving force in the realm of scientific knowledge,...theoretical research can point out in which direction the work should be guided in the future in order to realize the greatest achievement."[1] This is very true. In my personal experience, I realize that our nation's success in building the atomic bomb and the hydrogen bomb was truly inseparable from our early grasp of basic scientific research in theoretical physics.

In the spring of 1980, at the particle physics theoretical discussion conference held in Guangzhou, many Chinese-born scientists allowed us to talk about the development of science since the founding of new China. Their questions were very straight forward. They asked, was your first atomic bomb designed by the Russians? We said, no. The Russians did not design it, nor did the Jews, it was designed by ourselves. After the comment, they all laughed. Because the first American atomic bomb was developed with the participation of many Jews, and the hydrogen bomb was developed under the leadership of a

1 "Journal of Chemistry," St. Petersburg (1907), Russian Edition, p 111.

Hungarian Jew, Edward Teller. But we Chinese developed the atomic bomb ourselves. In the 1950's, a Soviet adviser came and said he would help us develop atomic energy, but he never said anything. We called him the "dumb monk." At the time, the design institute built for us was not like the ones in their own country, surrounded by many research laboratories and experimental laboratories. They began by saying we should build very beautiful buildings to let you make drawings inside. What was the basis for making the drawings? At the time, we had a figurative saying to describe the situation: The brain is in Moscow and the hands are in Beijing. The design institute became Moscow's hands extending to Beijing. If the brain did not give commands, the hands had to stop work. We pointed out at the time, should we build some peripheral experimental laboratories and research laboratories. He said they were not necessary. When you have the need, you can stand on our shoulders and climb up! This was such a smart saying! How easy it is to climb up on someone else's shoulders! But when this someone moves his shoulders away, you will not have anything to hold onto and you will fall down. Historical facts proved that this was the outcome. I repeat this history today to show that the nation's major scientific research and engineering projects must all have our own research foundation. Relying on others will never be reliable.

Everyone knows our nation's science and technology are still very backward in many realms. But cadres in theoretical physics, especially cadres in atomic energy theory, were trained by ourselves after liberation and under the party's leadership. They have victoriously completed the tasks handed to them by the higher authority and have contributed to the state. Several years ago I went to France. They thought it was a great feat for our country to develop the atomic bomb and the hydrogen bomb ourselves. They said, France developed its first atomic bomb earlier than China, but China developed its first hydrogen bomb before France. France developed its hydrogen bomb more than 7 years after it developed its first atomic bomb. We used only 2 years and 8 months. What was the reason? The Frenchmen of course had an estimate. We relied on our own strength and we were able to develop the hydrogen bomb only 2 years and 8 months after our first atomic bomb. Besides the party's correct leadership, I should say, our scientists grasped theoretical research in physics early and made the necessary scientific preparation. ehis was very important. In the viewpoint of the science of science, this coincides with scientific and strategic decision. It also coincides with the general laws of the science of science studied by comrades attending this conference, even though the term science of science did not exist at the time. Of course, we emphasize paying attention to basic research. This does not mean that it should share half the effort with applied research (including developmental research). According to the situation in industrially advanced nations and our own historical experience, basic research, when compared to applied research, does not occupy a large proportion in the distribution of scientific efforts. Take the atomic energy work begun in the 1950's after liberation as an example. Research in theoretical physics constituted about 5 percent while applied research and experimental research constituted over 90 percent. At the time, those engaged in theory started out in a small office inside a one-story house in a four-unit compound and courtyard. But because this 5 percent of the basic theoretical research team always remained active and continued to work,

to work after we successfully detonated the first atomic bomb, we were able to quickly enter the development of the hydrogen bomb, and we quickly achieved success. We were faster than France maybe because we saw further into the future than others in devising scientific tactics. Therefore, we should not neglect basic scientific research.

If we take scientific research as a whole, considering it in the overall situation of the whole nation's provinces, cities, higher educational institutions, industrial departments, national defense departments and the science academies, then, we should say, applied scientific research in our nation is far from enough. For example, in the provinces and cities, the most important is to carry out more applied research, especially applied research that combines with the needs of the provinces and cities. We cannot allow almost every province and city to engage in particle physics research just because a national particle physics theory discussion conference was held. Within the whole nation, we can have some comrades at several universities engaged in such research, but as a province or city, applied science that is most closely related to the locality and the national economy and that is the most urgent and the most important should be grasped. In some developed or partially developed industrial nations, there are many such cases. For example, in Australia, the problems with cattle dung and the "rabbit disaster" were solved locally by cooperative efforts between biological workers and medical workers. As a result, the development of agriculture and livestock production was greatly accelerated. In the 1950's, we successfully controlled locust in the Weishanhu area. This is also a very good proof. Before liberation, we would hear of locust disasters every 2 or 3 years. The locust covered the sky and consumed large expanses of food grains. After liberation and under the leadership of the party, our nation's biological workers and local scientific workers in various disciplines cooperated and learned the place of origin of the locust and its living habits, and they created a method to control and destroy it. During the last 3 to 5 years, locust damage has been basically eradicated. Such applied research work should be specially noted by local scientific research comrades. Similarly, industrial departments should emphasize industrial applied research related to their own industries. Agricultural departments should emphasize applied research in agriculture. The universities, I believe, should engage in both basic research and applied research. In the past, our universities emphasized education and paid insufficient attention to scientific research. I believe, first, scientific research in the university should be applied research to study problems related to and brought out by industrial and agricultural production in the province and city where the university is located. Second, scientific research in the university should be to appropriately develop exploratory basic research. With the addition of the Chinese Academy of Sciences, and according to the concrete situation of the distribution of scientific research efforts throughout the nation, according to the principle of "emphasizing the basics, emphasizing improvement, to serve the national economy and national defense buildup," and according to the spirit of strengthening the function of the Chinese Academy of Sciences in promoting the development of the national economy, the universities should readjust their scientific research tasks. In this way, I believe our whole nation, as an overall entity of scientific endeavor, can organically combine

basic research and applied research. The glorious task of our nation's four modernizations has a bright future.

An ancient Chinese saying said it well. All things can be done if prepared for, all things not prepared for will be a waste. If we want to realize scientific and technical modernization, we should analyze the overall situation of our nation's scientific endeavor now. We cannot repeat what others say. Chairman Mao said: "Analyzing a situation well is very beneficial." Now, the actual situation of our nation's scientific endeavor is that basic research, applied research, developmental research, or product research all need to be strengthened. Many of the comrades here today are theorists in the science of science and in management science. I hope that you will bring this point back to the localities and propagate this point throughout the nation and ask the leaders at each level to pay attention to this point. We are a socialist nation and also a big nation. As long as the leaders at each level understand this and conscientiously grasp this, then the victory of scientific and technical modernization will be firmly won.

(III) Party Leadership and a Good Scholastic Style Are the Fundamental Guarantees of Scientific and Technical Modernization

I have returned for more than 30 years, and I have always been involved in the organization and management of science and technology. Although some achievements have been made and some experience has been accumulated, many mistakes have been made, and I should admit that scientific research management to me is still a necessary kingdom that has not been completely understood.

As some comrades pointed out in research, a fundamental principle of the science of science is to manage science according to the characteristics of scientific research and our nation's characteristics. In my personal experience, the key to realizing scientific and technical modernization is to insist on party leadership. There must be a scientific research team with liberated ideology, with a spirit of creativity and a good scholastic style. In remembering the years 1953 and 1954, I realize that because the party's leadership was correct, because there was a relatively uniform group of leaders, and because the major leading comrades were enthusiastic about science, the leading comrades held an attitude of allowing scientific research personnel to have a free hand. Everyone felt comfortable. The situation was stable and united. Everyone wholeheartedly engaged in scientific research, and everyone contributed their talent. Therefore, party leadership and good cadres will fully mobilize the socialist enthusiasm of scientific and technical personnel. When they show shortcomings and make mistakes, they must be criticized and helped, but we must always do as Chairman Mao said: "To learn from past mistakes to avoid future ones, and cure the sickness to save the patient." We must start out from the point of view of cherishing them, because the purpose of criticism and help is still to let them develop a greater function in scientific research work.

In addition, scientific research personnel must be Red and expert, and they must consider this a working characteristic in scientific research. They cannot simply pursue form. They cannot be demanded to attend meetings here

today and give speeches there tomorrow. Some people do not like to speak but they work well.

At the particle physics theory discussion conference in Guangzhou in January 1980, many Chinese-born scientists unanimously believed that the most important aspect in scientific work is creativity when they talked about scholastic style. In a certain sense, without creativity there is no science. Creativity is the soul of scientific research. Creativity is the core and the quintessence of a nation's scientific capabilities. Therefore, we must insist on party leadership, carry out political ideological work, create a lively and active working environment for scientific research personnel and make it easy for them to fully develop and manifest their creative intellect.

Of course, the formation of a good scientific scholastic style similarly relies on the democratization of the academic environment. Everyone knows the key to science is talent. The world history of science shows that the growth and training of large numbers of able scientific and technical talent and even outstanding scientists are possible only in a profoundly academic environment. The training of talent at present in our nation is to develop fully the function of middle-aged and young scientists under the guidance of older generation scientists. They are now the backbone and hard core of our nation's scientific research. Therefore, on the one hand, we must advocate liberating ideology, and we must especially advocate that middle-aged and young scientific workers develop the spirit of creativity which young people possess, and on the other hand, we must advocate academic democracy, correctly treat creative academic thought, and avoid the suppression of new born forces which has occurred several times in the history of science. I believe that such people can be found at any time among people of any nation. They begin with a shallow foundation of knowledge, but they work hard, they do not fear authority, they are driven by an irresistable force and advance along the road of scientific research. And very outstanding achievements can be made only because of their hard work. But when they learn more and when they have acquired a special skill in a certain field, and when they become an authority within a definite period, they frequently become what some comrades had just mentioned, a person whose body of knowledge rejects or hinders the development of new knowledge. New-born things are thus in danger of being suppressed or discouraged. In the recent history of physics, a relatively famous case was the rejection of the young Danish physicist Bohr by J. J. Thomson. Everyone knows J. J. Thomson was a British physicist. He conducted a lot of vacuum discharge experiments and proved the existence of the electron. In 1897, he determined the electron charge to mass ratio in the study of cathode rays (electron charge e/mass m), thus he discovered the existence of the electron by experiment. At the time, the center of experimental physics was indeed in Britain at the Cavendish Laboratory at Cambridge, and the leader of this laboratory was J. J. Thomson. Although a generation of outstanding physicists were trained under Thomson, but, as a Chinese ancient saying said it well, "an intellectual has a thousand worries, and he will make a mistake." Because he made a lot of achievements in the study of the electron, and because electrons exist in every atom, therefore, in his mind, the electron should occupy the central position in the atom. His most brilliant student, Rutherford, held a different view of the atomic structure. Later, young Bohr

came to Thomson and talked about his idea of the model of the atom. Thomson heard him but did not believe him, and refused to accept Bohr to work there. Later, Bohr found Rutherford. At the time, Rutherford had left Cambridge. They had similar views on the structure of the atom. Rutherford asked Bohr to work with him, and not long afterwards, they finally created the Rutherford-Bohr model of the atom. This was the model of the atom with the atomic nucleus at the center surrounded on the outside by several circling electrons which we now use. Bohr later became a world famous first rank physicist. It was rumored that on J. J. Thomson's 70th birthday, he said regretfully that his greatest regret in his life was not to have accepted Bohr as his student. This story shows that when a person acquires a lot of knowledge and when he has a lot of authority, sometimes he will not easily accept new things. Such cases have frequently occurred in the history of science. Before a person becomes well known, he is frequently suppressed by other authority, but when he becomes famous, he may similarly suppress others. To say that he is devious is not necessarily true, but such facts indeed exist. Therefore, besides insisting on party leadership, we must greatly advocate a good scientific scholastic style. A good scholastic style is like a good work style, it is a shapeless force, and it can push forward and promote our nation's scientific endeavors to help develop healthily along the correct road.

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UPGRADING S&T MANAGEMENT BY QUANTITATIVE EVALUATION METHOD

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81, pp 24-26

[Article by Zhang Yihong [1728 0001 3414] of the Gansu Computer Center: "A General Quantitative Appraisal of the Societal Functions of Computer Centers"]

[Text] In the routine management of science and technology, it is necessary to make frequent evaluation of multifunctional technical departments geared toward societal service such as computer centers in order to analyze, determine, compare and appraise the performance of societal service and the contribution of these departments in a given period or in different periods of time so that comparisons can be made as objectively and accurately as possible.

The actual situation, however, is often relatively complex. In order to make a general evaluation, one must first divide the overall performance of the target under evaluation into a number of categories. Some of these categories may be qualitative performance and others may be quantitative. How should the evaluation results be integrated scientifically? Within the category of quantitative performance, the measurement units of various quotas are not always the same, so how should the computation be conducted uniformly? Different departments participating in the evaluation or the same department in different periods of time may provide a different number of services to the society, so how should the comparisons be made? And so on.

In order to solve this problem, we propose the following general quantitative evaluation method based on our study and investigation of scientific ability and wish to share our work with other investigations. The heart of this method is as follows: by establishing a mathematical model known as the performance index appraisal equation and with the aid of a simple calculation of a few single-item statistical indicators, a general performance index K can be found which is then used as the only quantity for comparison or measurement in the general appraisal.

We believe that investigations made with this model will provide some assistance in improving our S&T management standard and efficiency.

I. Parameters Considered in Appraisal Equation

In general, the contribution of a computer center to society or the performance of its societal function depends on the conditions of the surrounding environment and the need for a computer center. For the sake of simplicity, the effect of external environmental factors do not appear directly in the model; instead, they are taken into account when specific single parameters are determined.

In the investigation of the societal functions of an open public computer center, it is realized that this type of department should provide multifunctional technical services to the society, including offering machine time, software reprocessing, data storage service, organizing academic research on the development of computer applications, application promotion, popularization publicity, organizing technical information exchange activities using the computer, maintenance and repair service, and application of coordinated management.

Here we propose function parameters in eight different areas as the external variables of the model, and further divide them into four modules according to their role and status:

1. Equipment condition M:

M is a function of machine time parameter Y, software function parameter S_1 and data storage function parameter S_2.

$M = f(Y, S_1, S_2)$

2. Knowledge and intelligence N:

N is a function of information signal utilization parameter X, technical personnel structure function parameter T_1 and publicity and popularization function parameter T_2,

$N = g(X, T_1, T_2)$

3. Supplement V:

V represents other added noncentral service items.

4. Policy management G:

G represents the function parameter of management policy and external coordination.

Modules (1), (2) and (3) above belong to basic function and module (4) belongs to the high-level "amplification" stage.

II. Mathematical Model of Appraisal Equation

Let K be the function index of a computing time for a certain time interval representing the service function of the computer center to the society, then

$$K = G[Y\ (aS_1 + \beta S_2) + X\ (\gamma T_1 + \delta T_2) + \varepsilon V^2] \quad \ldots\ldots\ldots (i)$$

Suppose

$$M = Y\ (aS_1 + \beta S_2) \quad \ldots\ldots\ldots (ii)$$

$$N = X\ (\gamma T_1 + \delta T_2) \quad \ldots\ldots\ldots (iii)$$

$$P = \varepsilon V^2 \quad \ldots\ldots\ldots (iv)$$

then equation (i) may also be rewritten as

$$K = G\ (M + N + P) \quad \ldots\ldots\ldots (v)$$

In equation (i) the coefficients α, β, γ, δ and ε are all non-negative and in general not equal to 0. The sum $a + \beta + \gamma + \delta + \varepsilon = 1$ is called the weighting coefficient. We shall call equation (i) or equation (v) the appraisal equation of the computer center function index.

III. Determination of Function Parameters and Weighting Coefficient

1. Function parameters.

Based on the statistical method of specifying a series of single item evaluation criteria and indexes, we may assign the group of parameters, G, Y, S_1, S_2, X, T_1, T_2, and V specific values and take them to be parameters corresponding to the evaluation standard.

For example, in the determination of the machine time utilization parameter Y, we may specify the following "machine time unit" as an index for evaluation measurement:

(machine time unit) + (200,000 times/sec x 0.5 kilobyte internal storage x 1 operating user terminal x 1 hour of running time)

According to this scheme, a computer with a speed of 500,000 operations/sec and an internal storage of 1 kilobyte will provide 100 "machine time units" when five users used the machine simultaneously for 4 hours.

We may represent the magnitude of Y by the number of "machine time units" actually provided by a certain computer center during a given time period (a certain year or month). When several computer centers are being compared, one may use the number of "machine time units" of a certain computer center (considered to be an evaluation standard) as the base and set its Y value equal to 10, say, and then compare the number of "machine time units" of other computer centers to this base value and determine their Y values (a specific number greater than, equal to, or less than 10). When the performance of the same

computer center during different time periods is being compared, the same method may be used in determining Y.

In a similar fashion we can also specify the statistical values of the evaluation criteria and index for parameters G, S_1, S_2, X, T_1, T_2 and V. For certain qualitative items we may adopt an "ambiguous scoring method" and assign some quantitative values to these items according to the degree.

2. Determination of the weighting coefficients.

Weighting coefficients reflect the degree of influence of various parameters on the results of general appraisal. Their values may be determined by the leadership organization based on the statistical analysis of previous data, using relevant policies and regulations as a reference. For example,

$a = 0.3$, $\beta = 0.2$, $\gamma = 0.5$, $\delta = 0.2$, $\epsilon = 0.05$,

Weighting coefficients may be frequently adjusted according to shifts in policy emphasis.

IV. Applying the Appraisal Equation

First of all, statistical data and signal information for different time periods of all computer centers participating in the evaluation should be prepared and ready. Assuming that we have specified the statistical method for the indexes and the evaluation criteria for the function parameters, and the leadership has ordered the distribution of weighting coefficient values (or assigned before the appraisal), then we are ready to use the appraisal equation in conducting horizontal and vertical comprehensive appraisal.

1. Vertical appraisal.

When appraising the function index changes of a given unit for different time periods, a certain time period (must be a period of normal operation) may be arbitrarily chosen as the basis for appraisal, and all function parameters in this period taken to be 10, then the function index for this period is $K = 1000$. The item indexes in various time periods to be evaluated can be compared with those in the base time period and the values computed for the various function parameters in all the time periods (they may be greater than, equal to, or less than 10). Substituting these values into Equation (1), the function index value K can be calculated for the time periods. For example, $K_1 = 980$, $K_2 = 1150$, $K_3 = 1349$,.... Quantitative appraisal can then be conducted for the different periods of time.

2. Horizontal appraisal.

When the function of different units in the same time period are compared, one unit may be arbitrarily chosen as the standard for appraisal, and its function can be $K_0 = 1000$. Using a comparison calculation method similar to the above, individual item function parameters are first calculated, then, using Equation (1), function index K values of various computing center are computed, e.g.,

K_A = 1086, K_B = 1549, K_C = 798,.... Comparison appraisal can then be carried for different units.

It is clear that the values of various function parameters only have relative significance and that they are dimensionless quantities. Weighted operations can be made and the comparability is independent of the choice of appraisal standard.

V. Additional Remarks

1. As can be seen from Equation (v), the definition of the function parameters and the division of modules are universal. A technology can always be divided into hardware and software, and management is an "amplification" of the technical ability (the amplification factor may be greater than, equal to, or less than 1). If the management is in shambles and the policy decision full of errors, then no matter how great the technical force, it cannot play its role. Particularly, when G = 0 and K = 0, nothing can be achieved.

2. The supplemental module $P = e^{V2}$ is not the main mission of a unit and has little effect on the appraisal results. For this reason, a relatively small weighting coefficient e is used to attenuate its effect.

3. Using the appraisal equation as a mathematical model, one can clearly see the division of computer application organizations. This is valid even for some special cases.

(1) When Y = 0 or $S_1 = S_2 = 0$, we have M = 0. When no machine is available, the organization may be a computer technology workshop. In this case

$$K = G[Y (\gamma T_1 + \delta T_2) + \varepsilon V^2]$$

(2) When $M \neq 0$ but N = P = 0, the machine is available but research and promotion personnel are not. This would be strictly a computer room.

(3) When $P \neq 0$ but M = N = 0, the unit will be strictly a maintenance service station.

(4) Equation (i) can also be used in planning design or prediction analysis for the mode of development of a computing center. It provides some basis for decisionmaking. This method may be generalized to appraise not only similar department such as analysis and testing centers and information centers, but also the teaching and research abilities of higher educational institutes and the ability to treat and prevent disease of medical units, using the same method but redefining the meaning of various function parameters without losing generality.

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BRINGING SCIENTISTS AND SCIENTIFIC SPECIALISTS INTO POLICY-MAKING PROCESS

Taijin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81 pp 2-6

[Article by Xia Yulong [1115 4416 7893], Liu Ji [0491 0679], Feng Zhijun [7458 0037 3182] and Zhang Nianchun [1728 1819 2797] of the Shanghai Scienology Institute: "Leaders in Science Policy-making"]

[Text] The empirical policy-making with regard to small production, it is entirely up to the leader. The process of modernization construction is a process of transforming small production of to socialized large-scale production, and the policy-making must be made more scientific. What role should a leader play in science policy-making? How should this role be played? What aptitudes are required to play this role? All these are questions worthy of serious exploration.

I. Leaders and Scientists

So-called science policy-making is making decisions based on a sound scientific process, relying on scientists, and using modern methods and advanced techniques. Hence, in the process of science policy-making, the leaders and the scientists are two forces that should complement each other and there should not be a preference toward either. The correct handling of the relationship between them and development of their respective functions in decision-making is the key to science policy-making. On this basis, a leader must have sufficient understanding of the following three items:

1. The work of scientific specialists is an indispensable factor in science policy-making because:

(1) Each leader is a policy-maker with regard to the next lower level and an implementer with regard to the next higher level, so he has a lot of routine work to go through and it is impossible for him to conduct an in-depth analysis on each and every policy matter.

(2) Although many leaders are knowledgable and competent people, they cannot possess and explore a series of methods and techniques in science and policy-making. This is the specialty of scientists and experts.

(3) No matter how wise and thorough, one always misses something. The all-knowing and always correct leader simply does not exist in reality. Being in a high position, a leader must listen to the opinions of experts with an open mind in order to prevent or reduce policy errors.

2. The job of scientific experts is to assist the leadership in making policy and not to make decisions for the leadership because:

(1) Although quantification is an important factor in science policy-making, in practice a policy decision often contains some aspects that cannot be quantified or compared. For example, there is no common quantified comparison indicator for investment returns in industrial and culture departments. Besides, things are on different levels in the world; some things can be totally understood and described precisely in mathematical terms, some things can be explained clearly but cannot be described mathematically, other things can be sensed but not described verbally, and there are still other things that cannot be completely comprehended for the time being. All of these may require policy decisions. A specialist deals primarily in quantifiable work, computes the cost and benefit of various factors and the total cost and benefit of various proposal combinations, and works out the order of merit to provide the leaders with a scientific basis for policy decisions. The real key in policy-making lies in the value judgment regarding those aspects that cannot be compared directly; this is the leader's job and it also shows the level of his decision-making.

(2) The thought pattern and the scientific method and technique of a scientist are often based on ideal conditions; a policy decision, however, must put things into practical action. Understanding of a complex situation in action and utilizing various adaptive techniques are precisely the requisites of a proficient leader in a position of having an overall view.

3. The following three problems should be given proper attention in developing the role of scientists and specialists in decision-making:

(1) Let the specialists carry out their independent research. In any policy decision, experts must be allowed to draw their own scientific conclusion based on the objective situation in order to benefit the policy-making. The leaders should never be allowed to draw the conclusion first and then let the experts investigate the "facts" and invoke the "scientific principles" to "prove" the correctness of this conclusion. This type of decision-making, although it has the appearance of being backed by expert opinion, is actually fooling oneself.

The famous American management scholar Drucker was hired in 1944 by General Motors as a management policy consultant. On his first day at work, the company president, Sloan, told him: "I don't know what we want you to study or to write and I don't know what results you should obtain. These are all up to you. The only request I have is that you write down whatever you think is correct. You do not have to worry about our reaction or be afraid of our objection. Most important, you do not need to accommodate or compromise to make your proposals acceptable to us. Everyone in our company knows how to

accommodate and compromise, and we do not need your help on that. Of course you can accommodate and compromise, but you must first tell us what is correct so we can make the correct accommodation and compromise." These words of Sloan, who is praised in Western management fields as a "genius of modern organization," are worthwhile for the leaders and experts to think over.

(2) Let the experts play an adversary role. The nature of a brain trust which assists the policy decision is entirely different from that of a secretariat. The job of a secretariat is to comprehend and carry out the leader's intentions and it is judged by the accuracy of its comprehension and the thoroughness of its execution. The brain trust serves the policy maker with the results of its independent scientific research and it is judged basically by how much real knowledge and how many brilliant ideas it can come up with. Without different views and the courage to speak up, a brain trust will no longer be a brain trust. Whether or not accepted by the superior, the opinions and suggestions of the brain trust have positive significance; at least, it lets the leader hear both sides. We believe that if one-third of the suggestions of a think tank or a brain trust are followed, it is above average. If more than half of the recommendations are adopted, that is outstanding. But if 100 percent of the opinions are accepted, it indicates that either the scientists are exceeding their duty or the leadership is incapable, and this is very dangerous to policy-making.

(3) Do not be swayed by the experts. A leader must always remember that he is the one who makes the decisions. Scientists are also members of society and they are of various qualities; some do not hesitate to speak their minds and some like to go along with the leader's intention. Even among those who are not afraid to speak out, some of their opinions are correct and some are not. Thus, a leader that completely relies on experts is essentially neglecting his duty.

The best way to prevent being swayed by experts is to listen to the opinions of various specialists. One can make a judgment only by comparison. Do not be afraid of too many opinions, the key is for the leader to judge the opinions strictly on their merits, regardless of how close or prestigious the expert is. Furthermore, one should pay attention to an expert who is not afraid to speak the truth, especially if his candid opinion was rejected earlier and later proven to be correct. Otherwise, the capable people will stay away and one will be surrounded by narrow-minded people. Comrade Chen Yun [7115 0061] once said: "If you are constantly hailed by the people, any mistake you make will be a grave one." Policy-makers should take this as a motto.

II. How Can a Leader Make Scientific Decisions?

When the experts come up with a policy proposal based on scientific procedure and submit it to the leader, how should the leader contemplate, investigate and make a decision in a scientific manner? We believe that attention should be concentrated on the following four areas:

1. Investigate whether the proposal is consistent with the predetermined policy goal and value standard.

The policy goal is the predominant essential; if a proposal deviates from the policy goal or is irrelevant to the policy goal, then it is undesirable no matter how sophisticated the policy-making technique and mathematical method used in the proposal.

In evaluating the value of a proposal, one should primarily weigh those aspects that cannot be compared directly. Among the incomparable aspects, the only judgment factor is value. In general, there are three values--academic value, economic value and social value--and they should be treated without preference. Ordinarily there are social objective evaluations of all three values, and leaders should have a thorough understanding of them. But societal evaluations vary; a leader must have his own opinion and combine it with the societal evaluation so that he can achieve a certain effective balance between substances that cannot be directly compared.

One important aspect in weighing a policy decision is the principle of interest. There are only three situations: the first one is with advantages and without disadvantages, the second situation is with both advantages and disadvantages, and the last situation is with disadvantages and without advantages. Regarding the second situation, there are cases in which the advantages outweigh the disadvantages, the advantages and disadvantages are equal, or the disadvantages outweigh the advantages. Regarding the third situation there is also the difference of different degrees of disadvantage. In contemplating a policy decision, the case of advantages overwhelming disadvantages is naturally desirable, but in some real situations one would do well to opt for the least adverse condition. For example, because of a wrong policy decision in the beginning or because of a drastic change in circumstances, a certain engineering project has very little hope of continuing; then, although investments are already made, one should make a firm decision to call off the project in order to avoid further loss. There are often times when we have to take a small loss to make a greater gain; doing business below cost in order to occupy a corner of the market is one example. In short, a leadership that is always unilaterally hoping for the maximum gain regardless of the circumstances does not necessarily make good policy decisions.

2. Different types of policy decisions require different kinds of thinking.

As is well known, according to the nature of the goal, there are definite and indefinite policy-making (also known as regular and irregular policy-making. When a leader evaluates the research report of experts and makes the final decision, these two cases should be distinguished and given different consideration.

For definite policy-making, since the results are definitely at hand, the policy decision is simply choosing the optimum proposal based on available information. In doing this, the decision-maker should go all out with determination for the best result. Not enough determination and effort will mean a lost opportunity

and failure to obtain the optimum result even if the best plan is chose. This is a frequent cause of error in definite policy-making.

For indefinite policy-making, there are three considerations:

(1) "Play it by ear"; the pace should not be too fast. Avoid overconfidence and reckless action.

(2) Several schemes should proceed simultaneously in experimenting at the test stage. Each scheme should be different in principle. This not only makes the chance of success several times greater, but it also allows the accumulation of experience and even if the plan fails, the new policy will be on a good foundation.

(3) Concentrate efforts on signal feedback. Pay attention to information collection and consolidate the information in a timely way in order to make an opportune change of plan. In indefinite policy-making errors are unavoidable. The important thing is to discover errors and immediately consolidate the experience and change the course. If one held fast to the same approach even after errors were made, that would compound the errors and lead to disastrous loss. Never ignore the study of error, because a latecomer's success if often built on a pioneer's mistakes.

In addition, there are two more types of policy decisions in the indefinite category: risky policy-making and competitive policy-making. Each has its own rules of consideration.

For the risky type of policy decision, the following four considerations should be stressed:

(1) Choose the most promising plan of action.

(2) Prepare the necessary contingency plans so that any possible unanticipated event can be handled with ease.

(3) Have some leeway, such as backup troops in a war situation or a reserve fund in investment construction.

(4) Carry out test stage experiments whenever possible so as to change the high-risk policy decision into a more definite policy decision.

For competitive policy-making, the following four points should be kept in mind:

(1) Know your competitor well, check his strength and attack his weakness. The competitor's strength is an objective reality and cannot be denied or eliminated, but it can be suppressed so that it cannot fully develop. Pursue the competitor's weakness and use it skillfully. Causing the competitor to make the wrong decision is itself a good move.

(2) Know yourself well and develop your strength and hide your weakness. Attacking the enemy's weak point with your strong point is the basic criterion

of succeeding in competitive policy making. If you find that your weakness cannot be protected, then it is better to cease the competition and consider other alternatives. Never force it.

(3) Take the enemy by surprise and thereby eliminate the opponent's strength and your own weakness from the contest. Surprises cannot be used repeatedly, the "empty castle trick" [a bluff] is wonderful but Zhu Geliang [6175 5514 0081] would never have used it twice.

(4) Make the strategy dynamic. The key to winning a battle often lies in a timely switch of strategy. Whoever stays ahead of the game will have the initiative.

It should be pointed out that the rules of competitive policy-making stated above apply to international competition. They should not be used in domestic competition between enterprises under socialist conditions. Here mutual assistance and cooperation should be stressed. This point must not be neglected.

3. The essence of policy-making is a systematic viewpoint with the overall picture in mind.

In large production, everything belongs to some level of the system. Within a given system, there exist complex mutual interactions between the part and the whole. Something desirable to the part may not be beneficial to the whole and may even be hazardous to the overall situation. Conversely, something unfavorable for the whole will eventually affect the interests of the parts. This calls for the leader to have a systematic view and to make policy decisions from a strategic angle. Specifically:

(1) Policy decisions must be made with consideration given to the entire system, the relevant system and the previous policy. They should all be compatible and coordinated.

(2) There should be a thorough understanding of which systems will be affected by the policy results and what countermeasures and changes these systems will provide in response.

(3) The policy should be developed systematically. Not only is the policy-making itself a project of system engineering, but the execution of the policy must also be carried out step by step. Subsystems of the next stage must serve the big system of the previous stage. This is the only way to guarantee final realization of the policy goal. If a policy is not carried out systematically, it is at best a "slogan," and there is no specific guideline to follow in the execution of the policy; sometimes there may even be totally irrelevant activities taking place, and this is the biggest mistake of a policy. In his book "The Effective Executive," Drucker cited an example where a company decided to make certain changes while at the same time promoting several conservatives to the posts of director and deputy directors; consequently, the reform failed. When the personnel subsystem contradicts the reform of the overall system, the principle of systematic development is violated. Similar incidents are not unusual here. For instance, the reform

policy of our industrial management system is specialization of production. It is no doubt a correct policy, but the policy has not yet been developed systematically. Take the tax system; if a product is taxed every time it passes through a plant, the cost is greatly increased in specialized production. This will invariably impede the administration of the reform policy of specialization.

In making systematic policy, the policy-maker must always remember to look at the overall picture before attending to the details. When a department is planning development schemes, for example, the strategy, goal and fundamental principle should be established first, and one should never dive into specifics. Stacking up a number of projects is definitely not equal to planning. Only when the various projects are organically put together according to strategy, goal and principle is it real planning. The objective of devising a plan is not to strive for one or two "winners," but to improve the entire development ability. Of course, after the overall picture is clearly defined, the details cannot be neglected either. Failure at the final stage due to an error in some detail is by no means unusual. But detailed arrangements are the business of subsystems at various levels; the main job of a policy-maker is to deal with the overall picture.

It is rare to have a policy-maker who is expert on both major and minor matters. Understanding the big picture and being hazy about detail is fine, but a leader who is hazy about the overall picture and sharp about details will be in trouble. A policy-maker who is ignorant about both the overall picture and the details is a disaster. It should be explained that the reason it is undesirable to have a policy-maker who is sophomoric on the overall picture and sharp about details is because he only appears to be bright, but he fools people and he fools himself. Such a policy-maker not only jeopardizes the policy system but also learns no lessons from failure. As for a leader that is ignorant about both major and minor matters, the problem is that he serves no leading function.

Finally from a system point of view, a leader should have a complete plan in making policy decisions. He should never discard the whole proposal and only adopt part of it. This will definitely disrupt the system, and no matter how sensible the part is, it cannot function. Of course, this does not rule out the possibility of extracting the sensible portions from various proposals, but they must be made an organic part of a new complete proposal. In policy-making, it is very hazardous to compromise the pros and cons with a principle. There are only two kinds of compromises: one compromise is like King Solomon's verdict on the two women fighting for the infant--split the infant in half and let each woman have half. The other kind of compromise is the so-called "half a loaf is better than starving with no loaf at all." The first kind of compromise is obviously absurd, but King Solomon's verdict is not the only one there is. For example, when there are insufficient research funds, cutting the funding for each topic by half is equivalent to splitting a lot of scientific research into half infants. The second kind of compromise, although workable, is a simplification that will not lead to the optimum benefit.

4. Democratic decision must be taken seriously.

A key step before making a policy decision is ample free discussion. For a major decision, the lower level staff who will be responsible for the administration of the policy should also be invited to participate in the discussion (participate in the policy-making). Democratic discussion has the following four meanings:

(1) Different opinions expressed during the discussion result in more proposals to chose from.

(2) Discussion always further optimizes the policy proposal. In the discussion, the advantages and disadvantages of various proposals are adequately exposed and different ideas can shed light on each other and broaden the viewpoints. The optimum proposal can finally be obtained by acquiring the strength and overcoming the weakness.

(3) The process of discussion is actually also a process of acquiring a unified understanding of the policy. Once the policy decision is made, it can then be carried out with one heart and one mind. This not only reduces impedance in carrying out the policy and keeps the policy in tact, but also helps everyone to develop initiative, to create and to progress.

(4) The reliability of the policy can also be improved through discussion. In case the policy is proven to be wrong in practice, the original dissident opinion will often be a ready remedy and it will not be necessary to come up with new ideas on the spot or be in a bind.

Hence, a wise leader will not make any policy decision without hearing the opposing view. For example, former General Motors President Sloan once said during a discussion of policy matter in an executive meeting: "Gentlemen, it seems to me that we are all in agreement in our view." The participants of the meeting all nodded their agreement, but he continued: "Now, I pronounce this meeting adjourned and we will meet again to make the decision when we have heard some different opinions. By then we may gain some real understanding of this policy." One cannot say that the fact that General Motors became the leader of the world automobile industry is unrelated to this attitude of taking democratic discussion seriously.

When different opinions are aired in the policy-making process, it is particularly significant to have academic discussion, because academic discussions are evaluated on the basis of real insight and understanding, they are relatively removed from the various interests, and different opinions are more likely to be developed fully. Moreover, scientific discussion rules out circumstantial factors such as interpersonal relations and gets to the scientific core of the problem. Although decision-making should be versatile, the versatile factors can be handled correctly only on the basis of this scientific core.

III. The Decision-making Aptitude of a Leader

In a sense, the modern decision-making aptitude of a leader is the basis for scientific policy-making. Its basic requirements are:

1. Creativity

Policy-making is a creative activity and it always had the premise of altering the status quo. One can therefore say that without creativity there is no policy-making.

Any policy has its time period. Traditional customs and old rules and styles are the results of yesterday's policy. They may be selectively adopted, but they will never suit the present situation completely and solve today's problems. No matter how good they are, yesterday's policy cannot take the place of new policy. The famous economic management scholar, Nobel Prize laureate Simon, once said: "Management is a series of policy decisions." It is indeed an opinion with insight.

Even a talented leader with brilliant achievements should never be complacent. He still needs to be constantly creative and pay attention to strategic and overall innovation. Each level has its own strategy, and there is room for the talent of leaders at all levels.

To be creative one must break away from stale thinking, timid behavior and idleness. Since old ways had their success, their limitation is often masked, people used to old customs tend to hang on to them and follow them unconsciously. Therefore, following the old custom is the first culprit in dulling the creativity of a leader.

2. Scientific attainment

So-called scientific attainment is not a demand for the leader to master all scientific knowledge, for that would be impossible. Instead, it means that a leader should have basic training in science and possess a broad scientific knowledge and method of thinking.

Scientific training can be carried out through school education, but most important is self-education. One should study politics, economics, science and technology, management, philosophy, geology and history. In a word, one must be able to handle a multitude of social values and thereby conduct effective strategic thinking and make the correct value judgment on topics that cannot be compared directly.

In order to make science policy decisions, a leader should have the following scientific attainment.

(1) He should be skillful in the use of Marxist philosophy and the cognition and methodology of dialectical materialism.

(2) He should be familiar with a basic knowledge of economics.

(3) He should understand the basic ideas of system theory, information theory and control theory.

(4) He should study modern management and have a general understanding of modern administration.

(5) He should keep a close eye on the development and direction of domestic and foreign politics, economics, science, technology, education and culture.

(6) He should have a cursory knowledge of history, especially contemporary world history and the history of China.

3. A democratic work style

Democracy naturally implies that the leader should listen to different opinions with an open mind in making policy decisions; he should be particularly good at absorbing useful points from dissident opinions. But letting people speak out is not the entirety of democracy. Following suggestions is something even a "wise ruler" like Tang Taizong could manage. Democracy has its own deep scientific content and vigorous scientific structure.

Before a policy decision is made, all schools of thought should be allowed to aid their views without fear of reprimand, and different dissident opinions should in fact be encouraged. After the decision is made, it must be carried out in its entirety by everyone with one mind and one heart, and no discrepancy in action should be allowed. Both of the above are equally important and it is not true democracy without either one. Only scientists and specialists in think tanks have the privilege of always airing different opinions, because they do not participate in the execution of the policy and their job is feedback.

In the policy-making process, the democratic style of a leader can be demonstrated in the following ways:

(1) Sincerely listen to different opinions, not just pretending to be receptive.

(2) Be good at extracting different ideas. By repeated comparison and consideration of the overall situation, find the necessary material that meets the objective requirement out of the tangle of various ideas.

(3) Have the courage to adopt correct ideas. A leader may decide on a policy based on the opinion of the majority or he may go against the masses and follow the idea of a few people, it all depends on which is correct. The famous "National Income Doubling Project" of Japan was based on the opinion of a small minority represented by economist Shimomura Osamu and it finally succeeded.

A democratic work style is also illustrated by the leader's voluntary acceptance of responsibility when the policy is proven to be wrong.

4. Courage of determination

Time is a great resource in modern management and it is an important factor in modern policy-making. The optimum policy is always optimum with respect to a certain time and space and the conditions in this space and time. Therefore a leader must have timely courage to make a determination. Delaying a policy decision will bring about new risks in the process of delay, and the original optimum proposal will lost its base.

A leader's determination and resolve can also mobilize the subordinates and masses to carry out his policy confidently. Otherwise, even though the policy decisions are made, they are still in vain. Lenin instructed us to be firm to make others firm. Drucker wrote in his book, "The Effective Executive": "A manager must often speak with positive foresight in certain circumstances; lacking this ability may lead to grave consequences."

Among the four aptitudes for policy-making discussed above, creativity is the prerequisite for all decision-making; without creativity, the other three aptitudes are meaningless.

Comrade Chen Yun once said: "In our work we should spend more than 90 percent of the time studying the situation and use less than 10 percent of the time making decisions." This shows that science policy-making is not easy, it often takes a tremendous amount of effort and intelligence of leaders at various levels.

In the long practice of revolution and construction, our leaders at various levels have accumulated a wealth of practical experience. If they can further manage to use the procedure and method of modern scientific decision-making and improve their aptitude for science policy-making, their ability will be greatly enhanced and abundant, fruitful results will be achieved through their policy.

(Edited by He Zhongxiu [0149 6988 4423])

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BUILDING EFFECTIVE LEADERSHIP TO GUIDE AN EFFECTIVE SCIENCE POLICY

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81, pp 15-16

[Article by Xu Weixiong [1776 0251 7260] and Li Weikai [2621 4850 0418] of the People's Liberation Army: "Applying Systematic Thought, Strengthening Systematic Leadership"]

[Text] Just as the interaction and overlapping of various disciplines produced scienology, the interaction and overlapping of administration, politics and education formed the complete leadership of the party over science and technology. The system is an organic whole and the optimization of the whole system should be sought. In the party's leadership over science and technology, we should seek the overall effectiveness of administration, politics, and education. When only one aspect is stressed, it violates the principle of the system.

Today the following shortcomings exist in the leadership of science and technology: (1) The five large research systems characterized by administrative leadership are independent systems and do not form a complete structure of China's scientific system. (2) The leadership of sciences and technology is often singular; it may be administrative leadership, or political leadership, or academic leadership, but not an organic combination of all three. (3) The composition of the leadership often consists of only one factor; it may stress administrative leaders or it may stress scientists, but it does not stress a rational structure of intelligence or the optimization of the team. (4) The theoretical foundation for scientific and technological leadership is often limited to one discipline or specialty, and not the interactive combination of social sciences, natural sciences, engineering technology and management science. Because of these drawbacks, science and technology is inevitably partial and administratively it is often "rigid" or "all of one suit." For example, the electricity problem was unsolved after the Wuhan steel rolling mill was built; scientists are still advocating the construction of a fish channel after the Gezhouba dam has blocked the flow; investment on the Baoshan steel mill is already underway, yet the source of raw material has not been resolved. These are all examples demonstrating the problem.

Dialectic materialism affirms that the material world is a unified entity made up of numerous interrelated, interdependent, mutually constraining and mutually

interacting matters and processes. Systematic thought is the unifying of this material world and a concrete realization of dialectic materialism. The development of modern science and technology has further quanitified the method of systematic thought.

If we view the party's leadership of science and technology as a complex engineering system, then any policy decision in leading this engineering project not only requires the art of leadership but also the science of leadership. By using systematic thought combined with natural science, social science, engineering technology, scientific management and, especially systems engineering, then practical proposals based on quantitative analysis and scientific policies can be generated. In the mid-19th century, capitalist countries used engineering technology and developed their production; in the 1960's, industrially developed nations extensively applied systems engineering and achieved success such as the Apollo project; in the 1980's, we are consciously using systematic thought in leading our S&T effort, and this will have a profound effect on the four modernizations of China.

How do we use systematic thought in strengthening our S&T leadership?

I. Insist on Systematic Leadership

In systematic leadership, one must first organize the objects into a system (an organic entity with goals, functions and levels). Systematic leadership is not a leadership of point or line but a leadership in three dimensions. For example, a research unit as an operating system (it is also a subsystem belonging to a higher level) has a number of subsystems such as party affairs, scientific research, service and maintenance, education, and research management. Among these subsystems, there are mutual interaction (interpenetration and combination) and mutual reliance. These relationships should be realized in each basic link of the system. A leadership system should therefore possess the following features: (1) It should be complete. Adding up the merits of the individual parts does not equal the merits of the whole. The entirety can only be optimized when the constituent parts are logically unified and coordinated into the entire system. (2) It should be integrated. A complex system touches upon many aspects; it involves technological factors, economic factors and social factors, and it requires scientific knowledge of mathematics, management, economics, engineering, control theory, scienology and psychology. It would be exceedingly difficult for one person to know them all. In the actual practice of leadership, it is therefore important to organize various specialists and have them study with the leadership. (3) It should be practical. One should strive for the best results in carrying out a specific function of the system; however, specific functions of the system consist of many goals and targets, and sometimes one must seek a rational compromise or middle ground among conflicting functional requirements in order to coordinate the many factors. This is the practicality of leadership. This kind of systematic proposal based on pragmatism should be stressed in leadership.

How should systematic leadership be carried out?

First, an appropriate leadership structure should be established. The structure here refers to age, specialty, intelligence and aptitude. People of different ages have different intelligence characteristics and capability; a leadership group composed of people of different ages has a more rational age structure. A leadership group made up of different talents is a collection of administrative management talent, political leadership talent, "hard specialists" knowledgeable in special disciplines and "soft specialists" with management training so that the leadership can be "all knowing." The leadership aptitude consists of abilities to think, to express, to organize, and to direct. All these abilities can be realized collectively by having able thinkers, organizers and executors. A leader should be clearheaded, open-minded and knowledgable, and have broad interests and high integrity. Having such a leader will give the leadership group strong fighting power to coordinate and unify. Based on the discussion above, a leadership structure should be multidimensional and dynamic. Once formed it should not remain the same forever; it can be progressively optimized through constant practice.

Second, a powerful "think tank" should be set up. These are the "idea men" and "advisers" of the leadership and as a whole it is the research institute for policymaking and a "reprocessing plant" for thought. A think tank may recruit talent without being restricted to a specific type; it should broadly absorb creative middle-aged and young people so that it is vigorously active and sharp in perception. With proposals processed by such a pool of talent, the probability for error in decisionmaking by the leadership will be greatly reduced.

Third, coordination and equilibrium within the system should be strengthened. System equilibrium here refers to the matching of personnel flow, material flow and information flow between system and subsystems and between subsystem and basic links. For a given set of objective conditions, then this matching relationship reaches equilibrium, the entire system will function with optimum efficiency. Since the system is constantly in a dynamic state, the various systems may be coordinated frequently, so that they proceed from nonequilibrium to equilibrium, and from a new nonequilibrium and to a new equilibrium, and so forth. Efforts should be made to shorten the period of nonequilibrium and to consciously create favorable conditions for equilibrium in order to promote the development of scientific capability.

Science and technology have their intrinsic rules of development; this process may be enhanced or hampered depending on the action of the leadership. Science and technology is a whole entity and systematic leadership is a sensible conclusion.

II. Establish an Effective Feedback System

Feedback is a common phenomenon in nature, and the principle of feedback has been widely used. When feedback is not working it produces chaos in management. In view of the self-directing and self-feedback reality in China, it is particularly urgent and significant to establish a feedback system.

Based on the situation in China, we propose a feedback system consisting of the following components:

1. Science and technology associations and academic committees.

These academic organizations are meeting and activity centers for scientists. They constitute an enormous force in promoting scientific and technological development. Through the consulting and advisory role, opening up academic exchange and collaborative research will have a good effect on the party's science and technology policy.

2. Advisory organization.

Today some old cadres with leadership experience and old scientists and specialists with achievements have served as advisors to various levels of leadership. They have also formed an advisory group, office or corps, and have made suggestions on problems in the party's science and technology policy and practice. This is an important link in the feedback system.

3. Think tank.

In the present Chinese system, most S&T administrative leadership offices do not have an administrative or investigative research office devoted to policy research and investigation or doubling as a secretariat. Through situation assessment, research and reprocessing after the output of the signal, new or modified proposals on policy decisions may be proposed to help the policymaker regarding new decisions. This is also essentially a feedback process.

4. Information system.

People rely on information on their understanding of the society and the natural environment. International competition in science and technology primarily relies on a highly efficient information system. It may be said that information is a prerequisite for an effective feedback system.

5. Feedback management organization.

Based on the actual situation in China, management organizations at various levels could have two functions--that is, they may be management organizations and feedback management organizations at the same time. Personnel may be assigned exclusively to accumulate and collect various types of data. Reprocessing, analysis, and investigation are then conducted on the large quantities of feedback signal, and suggestons and specific proposals can be proposed from a scientific management point of view. This process will also play the role of feedback.

Naturally a feedback system also contains other components, but if we can consciously make the above items work, we will be helping to establish an effective system and make the party's leadership in science and technology even more scientific.

(Edited by Lou Lingru [1236 5024 0320])

SPECIALISTS, NOT BUREAUCRATS, SHOULD LEAD DECISION-MAKING PROCESS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81, pp 7-10

[Article by Wu Heqing [0702 0735 3237], Yao Dexi [1202 1795 0823], and Lou Daoming [1236 6670 2494] of the Hunan Provincial Science Committee: "Several Problems in S&T Policy"]

[Text] Establishing and carrying out the correct policies on science and technology is of strategic importance to the development of scientific and technological enterprise. For a long time there was essentially no practical, stable policy on technology because of major technical problems in the development of the national economy. The industrial fuel structure switched from the burning of coal to oil and then back to coal. The selection of railroad traction power was in controversy. All these issues resulted in great loss due to the ambiquity and switching of technological policy.

Experience has shown that the policy on science and technology as a guiding strategy and principle for the entire science and technology enterprise is a powerful weapon for the promotion of the national economy, and people use it in handling and adjusting the various internal and external relations in the realm of science and technology and in the promotion of the scientific and technological enterprise. We should make full use of this weapon and do a good job in science and technology management.

I. Principal Contents of a Science and Technology Policy

The scope of a science and technology policy is very broad and covers both macro and micro aspects--from major policy decisions on national strategic development to a specific technology policy regarding some local issue. We believe the major contents should include the following:

1. Science policy, or policy governing the development of natural science (theoretical science).

This policy deals mainly with development strategy and the overall goal of science. Examples are the infrastructure of a nation's science and technology, the arrangement of scientific disciplines, the ratio of military science and civilian science, the selection of leading science and the target for excellence.

2. Technology policy, or technological economic policy.

In establishing this policy, the technology of a specific field must be investigated to see if it is progressive, suitable and economically feasible. Regarding small steel mills and small chemical fertilizer plants, for example, the questions of whether they should be improved technologically or phased out and how to improve them or how to phase them out must all be spelled out clearly in policy form after investigation, study and conclusions are properly made.

3. Science and technology management policy.

This policy involves primarily investigation of the nation's scientific and technological development as a whole and the study of what policies need to be established to guarantee a coordinated development within the structure of science and technology and a consistent development with the external structure--the entire economy and society. A coordinated development of science, economy and society is the current policy of China's scientific and technological development. Regarding how to combine the three aspects organically in actual practice, there should be a set of methods, that is, there should be some corresponding policy regulation to insure the realization of this goal.

The reason that science and technology policy should be divided in this fashion is that science, technology and the management of science and technology are three different concepts, each has its own system and structure and is independent. Generally speaking, the essence of science is knowledge, a theoretical knowledge system consisting of various knowledge units, and is characterized by the exploration and understanding of the rules and development of and change in the objective world. The original meaning of technology is "skill." Skillfulness leads to ability and technology. Technology is the application of science and is a tool of labor. Science and technology are mutually related. From the viewpoint of science structure, science consists primarily of basic science, technological science and applied science. Each science category contains its scientific theory and its physical and chemical technology. Therefore, when we look at science and technology, we should look at their distinctions as well as their interdependence. Because they are different, they can be categorized, and because they are interrelated, the division is only approximate, relative and not absolute. A prominent trend in modern science is the combination and merging of different disciplines, and our thinking should adapt to this need. As to management, it was regarded as a "social education" for a long time and was not considered to be a branch of science. But experience has proven that an old hand in class struggle and mass movement may not necessarily be able to do a good job in science and technology management. Even someone experienced in production organization and management may not do well in science and technology management. Science and technology have their own rules and characteristics. The central task of science and technology management is to follow these rules and characteristics and to collect and process information regarding such fields as social psychology, behavioral science, technological economics and system science, and to carry out policy decisions, planning, personnel and fund deployment, organizational coordination, monitoring, and adjustment. To this end, a complete system of

procedures must be established to achieve the optimum results in scientific and technological development.

As can be seen, science, technology, and management each has its own structure and system, and the distinction and relationship between them are subjective. These problems must be taken into account in formulating policies on science and technology. It should also be realized that in reality the three types of science and technology policy, although each has its own emphasis, are often mutually interconnected and related and cannot be separated mechanically. For this reason, the important thing is to look at the policy itself and see if it reflects the requirements of the objective rules and whether it can advance the development of the scientific and technological enterprise.

During the period of economic readjustment, the Party Central Committee and the State Council have reiterated and emphasized the policy of science and technology serving the economic construction and pointed out the direction for our study of science and technology policy. How to adjust and modify old policies, what new policies need to be established, and particularly how to set up local policies on science and technology consistent with the actual local situation are problems of extreme importance and urgency. Scientific committees at various levels and various management branches of science and technology should actively promote and organize specialists and scholars to participate in the study of science policies and propose different plans for the choice of the policymaking offices. Policies calling for immediate study and formulation are: coordinated development of science and technology and economy and society; proportion of various investments for scientific research; policy on scientific competition and collaboration; talent development policy (or intelligence investment policy); policy encouraging scientists and technical personnel to aid remote and minority areas; and policy on technology transfer.

II. Basis for Drawing Up Policy on Science and Technology

The formulation of any policy must have a basis, and science and technology policies are no exception. Collectively, there is a theoretical basis and an actual basis.

The theoretical basis for establishing scientific and technological policy is scienology. Scienology is a comprehensive science centered on the study of the development of natural sciences. Under the guidance of Marxism, the basic tasks of scienology are exploring the intrinsic characteristics of science as a whole, investigating the rules of scientific development, and seeking the optimum method of scientific management in order to speed up the progress of science and technology modernization and to promote the scientification and modernization of the entire society. Therefore, one must possess and apply the theory of scienology in guiding the study and formulation of scientific and technological policies.

The so-called actual basis refers primarily to the driving force of scientific and technological development. This driving force can be divided into an internal driving force and an external driving force. Within science and technology there are rules of antagonistic movement, and this antagonism is the internal driving force. The other kind of driving force comes not from

within but from the entire society, that is, the external driving force is the multitude of factors affecting the development of science and technology. The formulation of science policy should be objectively based on both the internal and the external driving force. In addition, once the policy is determined, it also serves to adjust the relationship within science and technology and with the external environment, so that both the internal driving force and the external driving force can play their proper role and lead to satisfactory results. The dialectic relationship between science policy and the development of science and technology is well worth our attention.

Concerning the actual basis in formulating scientific policy, we should analyze the following three aspects:

1. Scientific ability.

Historical examples in science and technology cannot be used as a basis for formulating scientific and technological policy; only real scientific ability can be a reliable basis for establishing policy. The essentials of scientific ability are: scientific and technological staff and management personnel, research funding and equipment, literature and information, optimization of the scientific force and the level of a nationwide science education. Among the various factors, the human factor is the deciding factor of scientific ability. The percentage of scientific and technological personnel in the population is an important indicator in evaluating the scientific ability. In addition to quantity, quality should also be looked at. Quality may be judged from two aspects: one is the proportion of senior scientists and technical personnel and the other is the average age and the age composition of S&T personnel.

When we speak of the modernization of science and technology, the first issue is the modernization of scientific ability. The ranks of science and technology are the most volatile factor in scientific ability, and the quantity and quality of this group is an important basis for policy formulation.

2. Social momentum.

Science and technology are the means to achieving certain economic and social goals. If the economy and the society do not stress and make good use of this means, there will be no social impetus for the development of science and technology. Many complex factors enter into the social impetus; among them, the two most important aspects are: first, the scientific cultural level of the people and their demand on science and technology; and second, the actual ability of the societal economy to support science and technology.

Experience has shown that for a given set of circumstances, the speed of scientific and technological development depends on the degree of understanding, appreciation and awareness of science and technology by the people. In particular, it depends on the understanding, appreciation and specific action of the policymakers of the scientific organization management and the economic organization management regarding such important issues as "science and technology as a production force" and "science and technology leading the production construction."

We are now in a period of national economic readjustment, and the actual economic support is limited. It is not hard to understand that great sums of money for science and technology are an impossibility. The problem now is that the proportion of investment in building up the science and technology enterprise is not as clear-cut as the proportion of agriculture, light industry and heavy industry. Granted that there is no established international model on the proportion of research investment and that situations vary from province to province in China, but there still should be a proper and stable proportion. According to figures given at the inquiry of the third meeting of the Fifth National People's Congress, the percentage of China's scientific research expenditure relative to the annual gross value of production is: 0.88 percent in 1979 (final account), 0.86 percent in 1980 (budgeted) and 0.84 percent in 1981 (projected). This indicates that the proportion of scientific research funding in China is still small and unstable. Problems like this can only be solved by policy before the science and technology enterprise can enjoy steady progress.

In one aspect, economic and social development in the past relied very little on science and technology, nor did they provide much support for science. But we should also see the other aspect, that is, as clearly pointed out by the Party Central Committee, development in education, science, culture and health efforts should be continued as much as possible during the readjustment. As the policy of developing potential, protecting competition and promoting collaboration is being carried out, as the management of industrial and mining enterprises are being improved and strengthened, and as the rural production responsibility system is being improved and perfected, the degree of reliance on science and technology by industrial and agricultural production has reached an unprecedented level and the social impetus for scientific and technological development is growing constantly. In ideology and in action, we must keep up with the developing situation and make it our primary task to solve the key scientific and technological problems in economic development, improve the management standard and satisfy the needs of economic and social development with science and technology to the maximum level and make new contributions.

3. Ecological and environmental impact.

The policy of science and technology must be conducive to the ecological balance. In the early 1970's, an antiscience movement appeared in America and Western Europe, one of the reasons being that science brought disasters to mankind and produced pollution. This has cautioned us that attention must be given to ecological balances and environmental protection while we develop science and technology. For example, Hunan Province has superior geological conditions and natural resources, but for various reasons its ecological equilibrium has suffered serious damage, which has led to reduced forest coverage, deteriorating weather conditions, water and soil losses, silted up rivers and lakes, and a sharp drop in aquatic products. Because of a management style that pillages, the ecological system is severely overloaded and the consequences are evident. When we study and formulate policies on science and technology, we must stress strongly that under no circumstances will we trade a rapid development in industrial and agricultural production for the deterioration of resources and environment. Ignoring the protection of the

ecological system is committing a crime with regard to the generations to come. Therefore, in developing science and technology, we must consider the best economic effect as well as the best social effect. Scientific progress and human benefit should be the beginning and the end of the study and formulation of scientific and technological policies.

III. The Significance and Method of Scientific and Technological Policy Study

To formulate a science policy, one must have the correct theory, method and technical means. For a long time we have lacked a serious study of this issue. A strengthened policy study will undoubtedly help us gradually overcome thoughtlessness and one-sidedness in policymaking and establish a timely science and technology policy that is both rational and compatible with the situation in China.

In the extreme case, if a policy study were not conducted, it would cause great difficulty in the formulation and execution of S&T policy or even make it impossible. Policy study is therefore extremely important. Because of its importance, more and more people here and abroad are concerned with the study of S&T policy. By the early 1970's, there were 200 institutes in the world devoted to the study of S&T policy. There is one or more national level research institutes in every developed nation, and many developing nations have also established such institutes. In addition, international research institutes such as the international S&T Policy Commission and UNESCO have also been established.

In the early period in China, the Academia Sinica was not only the highest scientific research institute in the nation but it also assumed some management duties of the national science and technology effort. Major S&T policies were often proposed by the Academia Sinica and approved and acted upon by the then Political Council. By 1956 the National Science Planning Commission was established in the State Council, and in 1958 the National Technological Commission was established. In 1961, the Science Planning Commission and the Technological Commission were combined to form the State Scientific and Technological Commission. Since then, the study and formulation of national S&T policies have been conducted by the State Scientific and Technological Commission. Today, 18 provinces, municipalities and autonomous regions have established S&T policy offices.

When the State Scientific and Technological Commission formulates a policy, it first hears the opinions of science and technology workers in various departments. The S&T policy in question is first discussed in specialist groups and special meetings. The opinions are then consolidated and a policy paper is finally written and submitted to the State Council, which then evaluates, approves and promulgates the policy. This procedure serves as a good reference for us.

S&T policy study is an interdisciplinary investigation; it not only involves many disciplines in philosophical and social sciences but also some disciplines in natural science, technological science and engineering science. In order to

do a good job in S&T policy study, we must consistently rely on experts and scholars.

There are five methods in the investigation of S&T policy: (1) status investigation, (2) historical comparison, (3) future prediction, (4) systematic consolidation and (5) policy optimization. These five aspects are not only the working methods of S&T policy study but also the working procedure (or steps) of S&T policy formulation.

There should also be relative independence in the study of S&T policy. This independence is demonstrated in two areas:

First, a certain dependent relationship must be overcome. Today the management level of science and technology in China is not high enough, so that scientific and technological research is often led in a bureaucratic fashion and major policy decisions often rest with individuals. This dependent relationship must be overcome in carrying out policy study; otherwise, it will be impossible to formulate correct S&T policies.

Second, comment and discussion should be allowed on whether the current S&T policy is appropriate or whether the present policy should be adjusted and modified as time and the situation change. This is an important ingredient of policy and should never be neglected.

In this article we have given some of our parochial viewpoints and we do not expect them all to be correct; we welcome your corrections and criticism.

(Edited by Xiao Cheng [2556 3397])

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NEED FOR CONTINUED DEVELOPMENT OF SCIENTIFIC TALENT FOCUSED ON

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 1, 20 Jan 82 p 61

[Article by Yang Long [2799 7893] edited and released by Song Hezhou [1345 3109 3166]: "Developing the Strong Points and Avoiding the Shortcomings in the Employment of Scientific and Technical Cadres"]

[Text] In realizing the four modernizations, a very important link is the modernization of management. To improve our existing level of management, a fundamental strategic measure is to promote the large number of cadres who insist on the four basic principles, who are young and strong and who possess special knowledge, to the leadership posts at each level and to make the leadship groups younger, more intellectual, and specialized.

The selection and promotion of middle-aged and young scientific and technical personnel to the leadership groups at each level cannot be neglected and delayed. The urgency of this point has been more and more profoundly felt by all. Everyone has recognized that this must be grasped firmly and early.

There are a group of specialized technical cadres now, and some of them are in the technical vanguard. Some are comrades who have made great contributions in scientific research and who have already climbed the ladder of promotion to leadership posts. For example, a scientific and technical worker of a certain research unit had realized outstanding achievements in scientific research and was praised by the higher authorities. He attended the National Science Conference, and later won further trust and appointments and was promoted to deputy director of a certain research institute. Undoubtedly, there are many advantages in having such scientific and technical cadres lead and manage scientific and research work.

It is necessary to fill the leadership groups at each level with special technical personnel, and this must be done without reservation. But what type of special technical cadres should join the leadership groups so that their strong

points can be fully developed and so that they will benefit the building of the four modernizations? This is a problem that requires conscientious research and rigorous treatment. If it is not handled well, the opposite will result.

Take the above deputy director as an example, after his promotion, he had to attend this meeting today and that meeting tomorrow, make a report here today and talk about his experience there tomorrow. He had to hold more than 10 concurrent posts, and he was invited here and invited there, and his life was chaotic. In his own words: "I do not know what I am doing all day now, and I feel at a loss to handle all this." The masses complained: "He has now become a conference cadre, frequently attending conferences elsewhere."

This deputy director has already realized academic achievement. If he is allowed to continue to study and do more research, he may produce even newer inventions or creations. If some assistants are assigned to him to cut down his business activities, he will have more time to engage in research, and it is also possible to train another new force. But now, the result of his appointment has made it "difficult for him to handle the situation." This not only wasted his research work but also created loss and waste in actual work which cannot be calculated.

Now, in economic work, everyone often talks about developing strong points, avoiding shortcomings and developing superiority. Such a problem also exists in the use of talented people. We must develop their strong points and avoid their shortcomings, utilize their skills, appropriately arrange jobs according to their special own skills, interests and likes before we can fully mobilize their enthusiasm and creativity. This is the correct way of using cadres and caring about talented people.

We know that every one's knowledge, work experience and work performance are different. Some have a good grasp of basic knowledge and possess a wide range of knowledge, they are good at thinking through problems, and it is suitable to let them do research work. Some are very active, they are good at organization and liaison and they have a strong spirit in doing things. Therefore, we must select different cadres according to different work posts to let each of them be responsible and to let each of them develop his own capabilities. Scientific and technical personnel engaged in scientific research and scientific and technical personnel entering the leadership group are completely different according to work demand, the nature of the job and the content of the job. Each profession has its own special talent, different content and criteria, and they cannot be equated. A person talented in mathematics may not possess talent in organization and leadership. A world famous high energy physicist may not be able to organize and lead a high energy physics research institute with a hundred or a thousand members well.

Allowing scientific and technical personnel to join the leadership group is a necessity in building the four modernizations and changing the present structure of the team of cadres. This must conscientiously be done well. We must strengthen investigation and research and start out from actual work, analyze the overall situation and weigh the facts to see how we can employ scientific

and technical cadres so that they can better develop their strong points and make even greater contributions to building the four modernizations. People who are very talented in scientific research should be allowed to continue to develop their superiority in scientific research work. Do not force them into leadership posts and have them do work that has nothing to do with their speciality. Those people who possess the qualifications and who can better develop their function and who will be more beneficial to pushing the overall work forward after being promoted to leadership posts should be promoted without fear. The principle is rational employment. We must not suppress talent nor should we waste talent.

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THREE-STEP THEORY ON THE STUDY OF SCIENTIFIC DEVELOPMENT VIEWED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 1, 20 Jan 82 p 31

[Article by Zhang Jingchen [1728 2529 2525] of the Jilin Provincial Social Sciences Academy and edited and released by Zhao Beiwang [6392 0554 2598] and He Zhongxiu [0149 6945 4423]: "'The Three-stage Theory' on 'the Study of Scientific Development'"]

[Text] The "study of scientific progress" is basic research in scienology and it is used internationally to differentiate it from "the study of scientific policy." Analysis of related surveys conducted by the United Nations Educational, Scientific and Cultural Organization shows that the subject of "the study of scientific development" includes the three basic concepts of "science," "scientists" and "scientific study." This article briefly describes the content and the extension of these three concepts and their theoretical meaning in the basic study of scienology. The ideological method used here follows the "three-stage theory on the development of physics" proposed by Japanese theoretical physicist Mr Takeya. The so-called "three-stage theory" says that "the development of physics manifests the following three stages: First, physics describes the stage-in-itself of phenomena--the theory of the phenomena stage. Second, physics explores which stage-for-itself structures are possessed by certain actual objects--the theory of the objects stage. Third, physics studies what principles of motion are followed by objects in the stage-in-itself and stage-for-itself under mutual action--the theory of the nature stage. These three stages are not predetermined to occur in order. Because nature has such a symmetric structure, this development has come about because people's understanding of it has gradually deepened step by step. This is the consistency of historical development and logical structure." In fact, the subjects investigated by the "study of scientific development" has a similar symmetric structure.

The term "science," as defined in modern terms by the "Oxford" and "Ci Hai" dictionaries, refers to the system of knowledge about nature, society and thought. It is the sum of the fundamentals and the applied parts of natural science, social science, psychological science, mathematics, philosophy. Such a broad understanding of the concept of science is not an effort to disregard the historical fact that scienology has emerged and developed along with the emergence of "macrocosmic science" in modern natural science, rather, the trend

toward universality of modern science does not objectively allow for the classical narrow concept of science. Of course, out of the need for division in scientific research, we can limit the subject of study to within the realm of natural science, but we should not lable this "scienology," we should rigorously name it "science of natural science." This can clarify the conceptual confusion in the study of scienology. If we study the structure and structural variation of science as a system of knowledge, we can obtain a description of the theory of phenomena in "the study of scientific development" because "scientific progress" is the record of achievements, not the actual body of "scientific development." Therefore, science is the subject described by the theory of phenomena in the "study of scientific development."

What we call a scientist is a worker who is engaged in creative scientific exploration. He is the sum of the natural scientist, social scientist, pyschologist, mathematician and philosopher who engaged in scientific discovery, technical inventions and engineering creations. In the modern sense, the scientist exists individually and he also exists as a group which has a definite composition, structure, function and which is equipped with modern means and equipment of exploration. If the structure and structural variation of the scientists is studied as an explorer of knowledge, then we can obtain a description of the theory of objects in the "study of scientific development" because the scientist is the initiator who produces scientific knowledge and who develops scientific knowledge. He is the "actual moving object in scientific development." Therefore, the scientist is the subject described by the theory of objects in the study of scientific development.

What we call scientific research refers to the creative labor of scientists in carrying out scientific exploration. It is the sum of basic research, applied research and developmental research in nature, society and thought carried out by scientists. In the modern sense of scientific research, we often use "research and development" to bring out the characteristics of modern scientific research because developmental research has already become an important link directly connected to material production. Its investment is the largest and its social effects are the most obvious. If we take scientific research as an activity to explore knowledge and study the principles of dynamics of such activity, i.e., the principle of interaction of the various elements within the dynamic body and the principle of interaction of the dynamic body with the various external elements, we can obtain a description of the theory of nature in "the study of scientific development." Therefore, scientific research is the subject described by the theory of nature in "the study of scientific development."

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APPRAISING SCIENTIFIC INVENTION ON BASIS OF MARXIST METHODOLOGY

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81, pp 10-12

[Article by Duan Ruichun [3008 3843 2504] of the Chinese Science and Technology Information Bureau: "Probing Into the Standard for the Appraisal of Inventions"]

[Text] Invention is skillful creation by human intelligence. The quantity and quality of inventions are often indicators of the rise and fall of a nation's science and technology. Proper appraisal and encouragement of invention is an important S&T policy for any nation. In China, after the smashing of the "gang of four," the State Science and Technology Commission reissued the "Invention Encouragement Ordinance." Experience of the past few years has shown that this decree has played an active role in promoting invention and creativity, stimulating science and technology, and developing the productivity of the society. In the meantime, it has also raised an important issue in science management, namely, how to recognize the fundamental nature of an invention and how to establish an objective appraisal standard for inventions.

The second article of the "Invention Encouragement Ordinance" states that: "An invention is a major new achievement in science and technology. It must satisfy the following three conditions simultaneously: 1 it has not been done before, 2 it is advanced, and 3 it is experimentally proven to be applicable." These three conditions constitute the basic nature of invention, namely, novel, advanced and applicable. They may be considered the unification of the dialectic; they are mutually related and yet distinguishable from each other, and collectively they demonstrate the role of invention in S&T activity: from nothing to something, from the simple to the sophisticated, and from practice to theory and then back to practice. Therefore, in the study of the appraisal standard of invention, it all comes down to using the scientific view and methodology of Marxism in evaluating the novelty, sophistication and applicability of the scientific significance of an invention and the specific principles of judging and determining these three basic characteristics. In this article, we will provide only a preliminary exploration of these topics.

I. Definition of Invention

What is invention? Invention is a dynamic concept in the creative activity of technology, and we should give invention two dynamic definitions along with the progress of natural science. On this ground, we may specify our fundamental understanding of invention: 1) between science and technology, invention is in the realm of technology; 2) as compared to discovery and creation, the concept of invention is related and yet distinguishable from them.

It is generally believed that invention, discovery and creation all provide new knowledge and information to mankind; however, discovery often refers to the jump from not recognizing objectively existing objects, phenomena and principles. On the other hand, invention is a technological creation from nothing to something using the above recognition. But invention is not equal to creation. Creation is a concept that is deeper and more far-reaching intensively and extensively; it includes the formation process of a variety of material and spiritual achievements in the broad realm of human society. Invention is only a subarea of the broad concept of creation.

Obviously, from the nature of the subject, the theory and method in natural science and social science and the principles and calculations in mathematics do not fall in the invention category. Simple discoveries and literary and art creations are not inventions either. The kind of invention we wish to appraise refers to scientific and technological results that are technical in nature and are characterized by their novelty, sophistication and applicability.

II. Novelty of Invention

The novelty of a scientific or technological achievement can only be judged by comparing it with technology known and used before (we might call it current technology). Thus, the appraisal of novelty may be concluded by a counter-argument process: if a new scientific or technological result is technologically the same as some existing technology, then the new result does not have novelty. Otherwise, the new result would be novel. There are two questions here: what is current technology and how are two things judged as being technologically the same.

Regarding space, current technology may be regarded as the technology published in publications of the world, openly used and publicly known by society in various forms. Regarding time, there is no limit in dating backward. Regarding the medium, the criterion should be multimedia, such as information transmitted through oral reports, audio recording, video recording, television, movies and microfilm.

Regarding sameness, or judging whether two scientific and technological results are the same, one should first pay attention to two categories of sameness: 1) two techniques are identical, that is, there is no difference in the principle, mechanism or result of two inventions or technological results; 2) two techniques are partly the same and partly different; the part that is different, judging from the technological level of the time, is a simple

substitution of publicly known technology and the result of the substitution does not affect the quality and quantity of the result in any substantial way.

However, if a certain scientific or technological achievement appears to be a mere formal substitution of some well-known current technology but the result of this change corrects some misconception in the present technology and solves some longstanding technical problem and causes a substantial improvement in the quantity and quality of the product, then we can no longer view this invention as technologically equivalent to current technology, despite its simplicity and commonplace form. This is because a subtle innovation often contains significant and creative invention, and examples of this abound in history.

III. Sophistication of Invention

Sophistication is an indicator of the technological value and standard of the invention. Because scientific and technological development is a conflicting movement of inheritance and breakthrough, an invention must originate from current technology and surpass it, and the degree of advance must also reach a certain level. The judgment of this level should be left with experts in the field. The evaluation of actual results should of course be conducted by an evaluation committee consisting of representative and authoritative specialists.

Qualitative judgment of whether an achievement is more advanced than current technology is not really difficult. The term "advanced" here includes: 1) advanced in technical principle, 2) advanced in technical construction, and 3) advanced in technical results. But on the other hand, judging whether a certain achievement is advanced enough to be qualified as a major scientific and technological achievement and reaches the level of an invention is a rather complex issue. Here one should make a specific analysis based on the characteristics of different inventions. According to the nature of invention there are fundamental inventions, applied inventions, and general improvement inventions.

A fundamental invention is the material application of the newest scientific theory and often opens a new era. Examples of the transistor, the laser and the superconductor. In appraising a fundamental invention, one should recognize its advanced nature and judge its technological value from a practical and long-term point of view, and not be restricted by the narrow view of current technology and a single economic viewpoint.

An applied invention is the product of the transfer and proliferation of a fundamental invention into various special fields, such as the application of the laser and the superconductor in a technical field. Here one should distinguish whether the application is a simple transfer or modification or is a creative application. Generally speaking, only scientific and technological achievements with sufficient sophistication both vertically and horizontally can be regarded as having reached the level of an advance.

An improvement invention is generally a modification of an existing invention through the combination of already known technologies. Comprehensive analysis should be made regarding its separateness from other technologies, subject nature, degree of difficulty in the combination, practical impact, and technical and economic value.

IV. Applicability of Invention

Practicality is the only standard for testing the truth; it is also, of course, the testing standard of an invention's applicability. This should not, however, be interpreted as implying that a scientific or technological achievement is practical only after years of actual use. Because if this were the case, it would inevitably impede the birth of many superior inventions. Implementation and practical production are one form of proof of practicality; experimentation and other indirect proof deduced and concluded from technical implementation are also proof of applicability. The important issue here is that an applicable scientific and technological achievement must satisfy the following conditions: 1) consistent with scientific principles, 2) possessing implementation conditions, and 3) satisfaction of social needs.

In the meantime, to gain a proper understanding of the invention applicability, one must also use the dialectic viewpoint and clarify the following points theoretically: 1) Applicability and completeness. An invention not ready to be implemented (that is, an incomplete invention) is not practical, but this does not imply that all completed inventions are practical. Whether an invention is applicable depends on the possibility of its practical production. 2) Applicability and economics. Economic value and economic index are important factors in evaluating an invention's applicability, but they are not absolute. When it first comes into existence, the cost of a new product, material or technology may be very high, but its economic value improves as the product is gradually perfected. 3) Applicability and delayed implementation. Technologies that survive the challenge of long-term application are certainly proved to be of practical value, but this does not mean that inventions not yet put into practical production do not have practical value. In today's age of rapid scientific and technological development, "raising the question is often more important than solving the problem." Invention and innovation are more and more leading to industrial application. Many major inventions (especially signfiicant basic inventions) are often limited by the environmental condition, material and related fields in their industrial application, so a delay in implementation should be allowed. 4) Practicality and theoretical blindness. In appraising an invention, it is important to determine whether the invention agrees with scientific principles, but it is not important whether people understand the principle behind the invention. If someone accidently received a message revealed by nature and invented something that was proven to be really useful, then even though our understanding of the scientific principle behind the invention were lacking, this invention would be practical just the same. The fact is that the invention would still agree with the principles of science; it would be only that we were not aware of these principles at the time. 5) Practicality and benefit. An invention may have some negative effect along with its positive effect. In this case we should not dismiss the practicality of this invention lightly. In the long

process of technological development, any invention is not the end of technological development; the problem of eliminating these negative effects is itself a topic for future invention. Naturally the negative effect should be weighed against the benefits. When the adverse effect is so large that the society would not benefit from the invention, then its practicality is somewhat meaningless.

An important international trend in the question of appraising scientific and technological results and evaluating an invention patent is to treat novelty, sophistication and applicability as a whole. For our part, we should break our own ground on invention appraisal based on the scientific view and methodology of Marxism. It can be said with certainty that strengthening the research in this area will greatly enhance the prosperity of innovation and invention in China and yield more rapid scientific and technological development in China.

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SCIENTIFIC RESEARCH IN FACTORIES, MINES AND OTHER ENTERPRISES DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 68-71

[Article by Zhou Shensheng [0719 3947 3932] of the Administrative Office Science Committee of Wenzhou Prefecture, Zhejiang Province]

[Text] (I)

The development of modern economy and society is becoming more and more closely related to science and technology; science and technology have proliferated into various aspects of economic and social life and become indispensable factors of the development of economy and society. Marx once said: "Labor productive force is determined by many conditions, including the average skill of the workers, the level of scientific development and the extent science is applied in industrial technique, the social connection of the production process, the scale and function of production resources, and the natural conditions." (Complete Works of Marx and Engels, Vol 23, p 53) Here science and technology are clearly identified as important factors of the labor productive force. That is to say, it takes advances in science and technology to improve the workers' scientific and technological level and working skill, to improve the machinery and the mechanical efficiency, to use the natural resources sensibly, to develop the natural forces to the fullest extent, to effectively use labor statistics, to develop transportation means and to shorten circulation time.

The advances in modern science and technology are having increasingly greater effects on economic and social development. In the beginning of this century, technological advance accounted for 5 to 20 percent of economic growth and labor production increase in developed nations of the world, by the 1960's and 1970's, this ratio has increased to 50 to 70 percent. From 1977 to 1980 Shanghai textile industry has large scale increases in production, among the contributing factors, 71.4 percent are technological. The modernization construction must therefore rely on science and technology.

Marx divided the enlargement of re-production into two classes: extensive enlargement of re-production and intensive enlargement of re-production. "When the production field is extended, the enlargement is extensive; when the efficiency of the means of production increases, the enlargement is

"intensive." (Complete Works of Marx and Engels, Vol 24, p 192) The extensive enlargement of re-production relies purely on the quantitative increase in production elements, that is, the scale of production is increased by increasing labor, capital, equipment, material, and production field. In the past many comrades believed that only capital construction is enlarging re-production, they are only looking at the extensive enlargement of re-production. The intensive enlargement of re-production relies on advances in production technology, qualitative improvement of production elements, and improvement of the efficiency of labor and the means of production. This implies that current enterprises can achieve re-production enlargement through developing potential, restructuring, and improving without increasing new investments.

For this reason, the Central Committee stipulated that future economic development in China should not rely on building new plants but should rely on the full development of available enterprises and gradually switch from extensive to intensive. This is a fundamental change of our national construction policy and it is an economical and practical sound approach.

After 32 years China has achieved a fair scale and base in the construction of factories, mines and other enterprises and has formed a large rank of engineering and technological personnel. There are now 400,000 enterprises in China, the variety is complete but most enterprises have old equipment, undeveloped technology and a lot of potential. The development of available enterprises relies on the one hand improved business management and on the other hand sensible technological restructure, product quality improvement through new technology and new manufacture technique, reduced cost and consumption, increased product variety, and accelerated change-over of new products. If scientific research is to lead production construction, it must improve the technology development and promotion in factories, mines and other enterprises, bestow the enterprises with new vitality and move the national economy forward.

(II)

Science can become a direct productive force only by transforming into technology. The economic take-off of all developed nations in the world is always correlated with major new breakthroughs in technology. A member of the British Royal Society Kai-er-dun [phonetic] believed that the foundation of industry is not science but technology, industry cannot move forward without solving the technology problem. The fact that Japan rapidly developed into a major economic power after World War II is directly related to its adoption of a "build the nation on technology" policy. Although Great Britain is very advanced in science and produced a number of outstanding scientists, it has the highest number of Nobel Prize laureates in the world for its population, but because Britain did not pay attention to applied technology research and did not properly transform science into productive force to promote its industrial and economic development, the Great Britain is falling behind in economy. Judging from the experience of various nations, the enterprises of all economically developed nations pay great attention to technology development research and focus their business activity on it. These enterprises generally

use 3 to 5 percent of their production value or 15 to 20 percent of their profit to do scientific research. About 8 to 10 percent of their total employee are engaged in scientific research and these are all outstanding technical people. From 1945 to 1949 Japan was about 20 years behind the United States and European countries, the subsequent phenomenal economic progress in Japan cannot be separated from the role played by scientific research in its enterprises. Special consultant of Japan Electric Company and Ph.D. in engineering Dr Morita has said in a recent speech given in Hangzhou: "The government played some role in Japan's industrial development but most of the technological developments were made by private enterprises."

For a long time, scientific research in Chinese enterprises has received insufficient attention. There are two reasons. First of all, it is largely due to the "leftist" influence in economy and in technology. For example, in economic development attention was only focused on building new plants and starting new business and the role of the available enterprises was ignored. In scientific research attention was focused on highly sophisticated frontier science and the unpractical idea of overtaking the advanced international standard. Secondly, administrative methods were used to manage the economy, there were not enough competition among the products, the enterprises did not have enough autonomy and there was no internal driving force for the enterprises to do scientific research. In addition, China has been using the Russian system of scientific research since the 1950's, in which research organizations under the state's centralized management and enterprise research has a very small weight. In state-operated research organizations, everything is run by the state and research subjects are highly repetitious. The phenomenon of "eating out of the big pot" prevailed, research projects did not have economic accounting, and it took a long time to transform research results into productive force. In the near future the financial and material resources in China will be relatively tight but economic development urgently needs the support of science and technology. Therefore we must fully develop the technology restructure potential of the existing 400,000 enterprises. This dictates the important status of scientific research in factory and mine enterprises in the scientific research management system and makes it an indispensable part of the entire research system.

The Central Committee has now made technological improvement of the enterprises an important policy and the State Science and Technology Commission has also made technology development and promotion of factory and mine and other enterprises an important component of our science and technology development policy. But many leading comrades still lack sufficient understanding of this policy and all kinds of ideological blocks still exist. First of all there is the "iron rice bowl" concept, thinking that scientific research or no scientific research, there will always be something to eat. From the earlier experience on scientific research in factory and mine enterprises in Wenzhou prefecture of Zhejiang Province, the state-operated plants usually are worse than collective plants and large plants are usually worse than collective plants and large plants are usually worse than small plants. This is not a normal situation, state-operated plants and large plants have stronger technology base and better conditions, they should lead the enterprises in scientific research but in fact it is just the opposite. As the economic

management system improves, the "iron rice bowl" kind of thinking must be cracked. Second , scientific research is considered to be soft assignment and production is considered the hard assignment. Scientific research is thought of as the water too far away to put out a nearby fire. Some even think that when production is busy, research can wait. "Scientific research can be put off, if it doesn't work this year, there is always next year." No one looks at research from the strategic point of view. Third , people think of production development largely in terms of supply and sales. There is no comprehensive understanding of the mutual dependence of production and circulation. People fail to realize that one can have rapid enterprise production development only when the products are competitive and supply and sales are well organized, and product competition is essentially a competition in technology. Fourth , scientific research is mystified. People think of scientific research as highly sophisticated and esoteric and cannot relate scientific research in enterprises with the reality of technological improvement. When it comes down to it, all these misconceptions are due to lack of understanding of the relationship between scientific research and productive force, economy and technology, the vital significance of development of potential, improvement and restructure of the enterprises, the role of scientific research in improving production and the competibility of products, and the proper direction of enterprise research.

(III)

Doing scientific research and not doing scientific research make a big difference to an enterprise. Here are some examples from the Wenzhou prefecture:

1. Survival and development of small plants: Yongjia county radio plant is a small county-operated plant. It had a hard time getting established in July 1978 when it had only 10,000 yuan in the bank and could not afford to buy 20 jin of machine oil. It had only one kind of product and its monthly production value at the time was only 13,800 yuan. In the last two years or so, the plant stressed the role of research personnel, conducted production technology research and carried out more than 50 technology improvement projects. They experimentally manufactured 10 new products and came out of the dire situation, their production increased rapidly. In 1980, the plant had a total value of production exceeding 1.9 million yuan and made 160,000 yuan of profit. The projected 1981 value of production is 1.5 million yuan and the profit will reach 200,000 yuan. When they say "If an enterprise is to survive and develop, it must get into scientific research.", they are speaking of their experience.

2. Replacing old products: Pingyang county chinaware plant No 1 is an old plant with 300 years' history and it has been producing China bowls for 300 years with the same method. From 1974 to 1976 the plant had a loss of 300,000 yuan. In the past several years they established a technology research laboratory, made a major effort on scientific research and technological improvement, and created more than 300 new patterns and varieties. After that they have not only changed loss into gain but their production has also increased year after year. In 1979 their production value was 1.34 million yuan, 21 percent more than that of 1978. In 1980 they have completed 1.56 million yuan

of production which is 17 percent higher than the 1979 figure. The entire outlook of the plant has had fundamental changes and they are now busy meeting production assignments. As can be seen, the solution to renewal of old products also lies in scientific research.

3. Quality improvement of traditional namebrand products: Ruian County dairy product plant has been producing sweet condensed milk for 55 years and their product has been selling well on the international market. In 1977, their product was rejected because their condensed milk was found to show fat separation and thickening while in storage. The plant established a research office in 1978 to deal specifically with this quality problem. The problem was finally solved in 1979 and the solution was applied to mass production. Export has since increased and the consumption of fresh milk was reduced as well. This item alone brought in 164,000 yuan of profit in one year. Hence, traditional namebrand products also need scientific research to constantly improve their quality.

4. Development of collective enterprise: Leqing County science committee, in close collaboration with economic departments, made an effort to promote scientific research and technological improvement in collective enterprises. Just the 64 collective enterprises under the second light industry bureau have developed and put into production 23 new products in the last 2 years. Eleven of those have entered the international market and created 7.88 million yuan of foreign exchange for the state. Moreover, 193 new varieties, patterns and packages were experimented and put into production, thus stimulating a number of enterprises on the verge of folding or with minimum profit. The level of production technology was rapidly improved and the whole situation was quickly changed for the better.

In a word, scientific research in enterprise has many advantages and great effects. First of all, research is the center of potential development, improvement and restructure and is an inevitable path to the survival and prosperity of enterprises. It speeds up the pace of enterprise modernization and the entire process of industrial development. Secondly, the expenditure comes from within the enterprise and it saves the state great amounts of financial resources. It takes little investment and yields great economic benefits. Thirdly, the research topics come from production and the results are turned back into production. It facilitates timely promotion of research results and shortens the time required to transform research results into productive force. Fourthly, technological force, equipments, and experimental facilities of the factories, mines, and other enterprises can be fully used. Finally, research helps the enterprises to train their technological ranks.

(IV)

Based on the experience of research effort by enterprises in Wenzhou prefecture in the last two years, we believe the following items should be stressed if we are to do a good job in promoting scientific research in the enterprises.

1. The direction of enterprise research should suit the enterprise in question and emphasize problems at hand. Import, promotion and application should

be stressed to solve urgent technological problems of the enterprise in question. Scientific research should serve potential development, improvement and restructure.

2. Properly select research subjects by following these criteria: (1) research should be in the right direction, (2) pay attention to economic benefits, (3) use the resources sensibly, (4) conserve energy, (5) combine long term and short term goals, pay attention to technological reserve. The objectives should be developing new products for the enterprises, improving old facility and old manufacture technique with new technology, improving product quality and strengthening the competibility of the products.

3. Through research contracts and research-production combination, closely collaborate with institutes of higher learning, research institutes and large plants and mines. This practice will on the one hand let each unit develop its strength and let small plants overcome their difficulty of insufficient technological force and information and on the other hand helps the transformation from research results to productive force.

4. Stress intelligence investment and development. Improve technical training, make sensible use of currently available technological personnel in the enterprises, pay attention to experienced and self-taught talents, actively attract talents, hire retired technical staff and old masters as consultants.

5. Put information work in order. We should not only pay attention to scientific and technological news but also market economic information. Scientific and technological staff may get ideas from domestic and foreign academic papers, exhibitions, samples and photographs. The purpose of engaging in information work is to select and introduce appropriate technologies for the development of our own enterprise. Imported technology should be digested, restructured and improved.

6. Establish the necessary organizations. The enterprises should concentrate their technological force and individually or collectively establish scientific research organizations such as research institute, research (design) office, and scientific research group (experiment group, technology improvement group). We should pursue the substance and not the style. The research personnel should be relatively stable to ensure continuity, avoid using research staff as "fire fighters." There should also be a fixed place for experiments (experimental shop), and certain means for experiment and equipments and instruments. We should adhere to thrifty and frugality and should not place undue emphasis on things that are big and foreign.

7. Attention by the leadership is of key importance. Administrative departments in finance and in technology should be matched closely to give research activity the proper concern, support and specific guidance. The enterprise leadership should place technology development and promotion on important agenda, strengthen the ideological and political work, provide timely assistance to overcome specific difficulty and treat scientific research like production duty.

Technology development and promotion in enterprises is after all a new endeavor, further exploration and consolidation of experience are needed. Many problems are waiting to be investigated and solved. Clear stipulation in policy and support are especially needed. To name a few items in this area:

1. The enterprises are mainly responsible for their scientific research expenditure. Possible avenues are (1) take it out of production cost, (2) funds may come from capital for developing potential, improvement and restructure or from equipment renewal capital, (3) technical service income, (4) after the enterprises are given more autonomy, research funds may come from enterprise foundation or from the portion of profit retained by the enterprise, and (5) special project loan may be applied for major projects.

2. Material needed for scientific research may be included in the enterprise supply channel. Major projects may be appropriately supplemented by material department, and equipments and instruments may be supplied by scientific instrument department.

3. Financial departments should provide policy support in the area of loans, taxes, and pricing. For example, low interest loans may be provided to enterprises for scientific research, new products may be granted tax free or reduced tax status for a given period of time, and enterprises may be allowed to set their own price for new products and sell their products on the market with the approval of price department.

4. Personnel and labor departments may provide assistance in attracting and discovering talent and in the sensible use of personnel. Technical staff transferred into collective units should be treated equitably. Enterprises should be allowed to hire part-time research staff from institutes of higher learning and research institutes. Personnel in enterprise research organizations (including technical cadres and experiment workers) should have production staff classification and enjoy the same benefits as shop workers.

Technology development and promotion of factories, mines, and other enterprises is a new service. Its development will tie science and technology closely with economic and social development and it is showing more and more vitality in promoting the industrial construction of China.

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PROBLEMS IN DEPARTMENTAL STRUCTURE OF S&T RANKS AND THEIR SOLUTIONS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81 pp 39-41

[Article by Dai Guangqian [0108 0342 0467] of the State Council Science and Technology Cadres Bureau]

[Text] Economic adjustment has two parts: one is the rational reorganization and unification of economic structure, and the other is the technical improvement of old enterprises. Both are closely related to the structure of S&T ranks. A rational economic structure calls for a rational structure of S&T ranks. Without rationally structured S&T ranks, the effort of technical improvement cannot succeed.

"Departmental Structure" of S&T Ranks

According to a report submitted to UNESCO by the State Scientific and Technological Commission, there are five parts to the Chinese S&T ranks: the Academy of Sciences and its local branch institutes; departments in the State Council and local research and design institutes; research organizations of colleges and universities; S&T ranks in plants, mines and villages; and S&T ranks in defense. The departmental structure discussed in this paper is not made up according to this division; instead, we are investigating the division and organization of S&T ranks in the major departments of the national economy. We shall emphasize study of the quantitative structure of engineering and technical personnel in major industrial departments.

In 1978 there were approximately 4.35 million scientific and technological staff members in the national units. The distribution is approximately 40.6 percent (of the total S&T personnel) in culture, education and health departments; 8.2 percent in agriculture, forestry, water conservancy and weather departments; and 27.7 percent in industrial departments. This is consistent with the overall situation in China, where the 1 billion population requires basic educational and health service, agricultural and forestry lack technical personnel, and industry is reasonably developed.

In 1978, more than half of the 1.571 million engineering and technical personnel in public units were concentrated in industrial departments, although capital construction, telecommunications and transportation departments each

had a certain number of engineers and technical people. A total of 851,000 were in industrial departments, 14.5 percent of which were in light industry and 85.5 percent in heavy industry. Moreover, almost two-thirds (64.2 percent) of the engineers and technical personnel in industrial departments were concentrated in two areas: machine building and metallurgy.

The Present "Departmental Structure" of the S&T Ranks Is Not Meeting the Needs of National Economic Readjustment

For a long time the economic construction in China has followed the route of heavy structure, the priority of capital goods development was stressed, and the production of consumer goods was ignored. The production of capital goods was "self-serving" and kept going around in the heavy industry circle, while service for consumer goods production was neglected. From 1949 to 1978, the growth in heavy industry was more than 90-fold, light industry grew 20-fold, and agriculture grew more than twofold. The development of capital goods production far exceeded the development of consumer goods, and an anomaly resulted. Not only did supply fall more and more behind demand in capital construction, industrial production and market supply, but the national economy turnover was sluggish, production and construction were both highly wasteful, and the economic efficiency was very poor. If this situation were allowed to continue, not only would it be impossible to improve the people's standard of living, but production and construction would both run into great difficulties. The ultimate goal of our national economic readjustment is to begin with the current situation in China and reorganize the economic structure rationally, gradually shift our economy from a passive to an active position, and pave the way for a Chinese-style modernization. The present task is to readjust the production from a heavy structure gradually to a sensible light structure.

The production of consumer goods is an integrated reprocessing procedure. Many academic disciplines and technologies are involved in this process, from material supply to reprocessing to production and packaging. The development of consumer goods production is relying more and more on science and technology. At the present time, the light industry S&T effort is very inappropriate for the development of light industry, an important field in consumer goods production. One of the important reasons is the lack of S&T personnel in the light industry departments to match the task. As far as the departmental structure in S&T ranks is concerned, the "heavy structure" in engineering and technology has not been changed very much.

As a result, the S&T force in light industry turns out to be inadequate everywhere, and the situation is in sharp conflict with the current production development. For example, bicycles produced by the Beijing Bicycle Plant are slipping year after year in the national bicycle appraisal, and yet demand for production keeps rising. Out of 3,300 workers at the plant, only 34 are technical personnel, and the entire plant has no specialist in paint baking, electroplating or welding. Another example is that Beijing produces 2 million dozen soft drinks and the supply is still behind demand. This is partly because the only efficient bottling machine, moved in from Shanghai, is of 1930 vintage and often breaks down; it sometimes runs and sometimes quits and has never been properly fixed. Some say this is because of a long unresolved

technical problem in pressure. As for the development of convenient food for solving the eating problem on the new long march, even more technical difficulties are encountered. No wonder comrades in light industry departments have said: "We can launch our rockets into the sky and we can recover our satellite, but for the cover of a light package, we still have to buy a foreigner's patent."

According to the requirements of national economic readjustment, the industrial production mainly of the machine building industry should be decreased, then the production of the steel industry should be decreased by a smaller scale. These two departments happen to have the highest concentration of engineers and technical personnel. As heavy industry changes its object of service, although some engineering and technical personnel have joined various technical duties in light industry such as equipment renewal, technological improvement, and production, many leaders and technical staff still believe that this is a matter of expediency and not the norm, and therefore pay little attention to gaining new knowledge and improving technical standards in these fields. As a result, the heavy structure of the engineering and technical ranks has not been changed substantially. This situation is still a far cry from the needs of national economic readjustment, and particularly from the final goal of the national economic readjustment.

The Reasons for the Incompatibility of "Departmental Structure" in S&T Ranks and the Current National Economic Readjustment

The most fundamental reason leading to the problem described above is that the development of the S&T ranks in China is suited to the needs of the heavy structure development in the national economy and does not conform to the current readjustment of the national economy. It is a historical factor.

Before liberation and under the reactionary ruling of the Kuomintang for more than two decades, the higher education only produced 180,000 graduates. After these engineering and technical people left school, their first concern was to find a job, and many people were forced to give up their specialty because of the job problem. At that time the liberated region did not have a modern industrial base, work in many other areas urgently needed large numbers of revolutionary cadres, and many special and technical people who participated in the revolution had to work at other posts. Up to liberation, China had only 50,000 scientific and technological personnel, which is hardly a team, not to mention a reasonable structure.

After liberation, starting in 1953 and 1954, China began its large-scale economic construction centered on 156 engineering projects under Soviet aid. Heavy industry was given priority in order to insure the equipment and material needed in agriculture, light industry, communication and transportation, and defense. This was entirely necessary and correct. At the time attention was also given to the equilibrium of coal, oil, electricity and transportation and to the coordinated development of heavy industry, light industry and agriculture. To meet these needs, the engineering and technology ranks grew from 130,000 in 1952 to almost 500,000 in 1957. Because the average annual growth of heavy industry was almost three times that of light industry, it

was natural for the engineering and technology ranks to become a heavy structure The distribution is shown in the table below.

After the beginning of the second 5-Year Plan the development of heavy industry was still excessively stressed; the priority given to heavy industry was even simply interpreted as priority in developing the steel industry, and the national economy was planned centered on steel production. This practice restricted and hampered the development of light industry and agriculture and caused a long-term short supply in the fuel power industries of coal electricity and oil; the construction materials industry; and communication and transportation enterprises. Without a proper balance the entire national economy could not develop smoothly and even encountered great difficulty. During the second 5-year plan, the development pace of heavy industry was five or six times that of light industry. To meet this situation, various schools naturally stressed the needs of heavy industry in their training of engineering and technical people. Take the engineering majors in colleges and universities between 1957 and 1962, for example: the average growth of metallurgy students in school was 24.9 percent, whereas the average annual growth of the number of students majoring in light industry specialities was only 12.2 percent. Correspondingly, the average annual growth of engineering and technical staff in metallurgical industry was 18.9 percent, and the textile industry had only 5.7 percent. Not only was the rate of increase slow for light industry technical people, but there were also fewer specialty categories. As late as 1980, only 46 of the 453 specialities in 15 engineering categories in higher education were directly related to the development of light industry and textile industry, or only 10.15 percent. Thus, the engineering and technology ranks in industrial departments became oriented more and more to heavy industry in the long process of development.

Next, because of the influence of the "leftist" thought, intellectuals were treated improperly and errors in management gradually locked technical staff into departments, regions and units, and made them immobile. The departmental structure of the S&T ranks has become a "rigid structure." Hence, even though the national economic structure has begun to readjust, the structure in S&T ranks is still not turning around.

In fact we were not this rigid in the early period after liberation. In 1952, when the war to resist U.S. aggression and aid Korea was going on, it was decided by the Political Council of the central people's government that 1,000 technicians and 4,000 technical workers in aviation, automobile and tank engineering would be drafted from various large administrative prefectures and departments of the central government to strengthen the defense industry. In 1953 when China launched its large-scale economic construction, RENMIN RIBAO published an editorial entitled "Let Technical Specialists Man the Posts Most Needed in Economic Construction," which emphasized that "without a sufficient number of specialists and technical people, it would be impossible to transform China from an agricultural country into an industrialized country" and pointed out the necessity to solve the problem of irrational use of special and technical personnel. In the next year, in an attempt to meet the urgent industrial construction needs of the time by concentrating resources and first solving the rational use of industrial technological cadres in a short time,

the Political Council of the central people's government further decided to register, concentrate and assign those industrial technological cadres in 14 specialties--including civil engineering, architecture, mechanical engineering and electrical engineering in offices above the county level, state-operated enterprises, private and public jointly operated enterprises and institutes of higher learning nationwide--who were improperly assigned or were unable to put their knowledge to good use, to major industrial construction posts. These practices met the economic construction needs of the time and reflected the "flexible structure" of the S&T ranks. It has been more than 20 years since that time and the S&T ranks now are quite different, but today it is exceedingly difficult to transfer special and technical personnel even among research, production and teaching branches in the same department, not to mention between different departments. It is even more difficult for heavy industry and military industry to provide systematic, organized and directed technical assistance for light industry and textile industry. If this situation were to continue, it would be very difficult to readjust the national economy.

Problems To Be Solved in Changing the Departmental Structure of S&T Ranks To Suit National Economic Development

Because the departmental structure in S&T ranks was formed over a relatively long period of time, it will not be easy to change it; it may even take longer than to change the economic structure. In order to meet the needs of national economic development, we should begin solving problems in three areas: planning, implementation, and methodology.

In the long run, the "departmental structure" in S&T ranks should be studied in terms of national economy, science and technology, education and even the unified development plan of the entire society in all provinces, municipalities, and autonomous regions in the nation, and corresponding plans should be formulated. This would require the collaborated effort of departments in charge of economy, education and science and technology; it would be impossible for one single branch to solve the problem.

For now, we must take some emergency measure to meet the needs of economic readjustment. In order to strengthen the S&T ranks in light industry, there are three things we must do. First, great effort must be made to train reserves, existing institutes of higher learning in light industry must be run well, and secondary vocational schools must be selectively reinforced. Second, technical professional titles should be given to those workers who have acquired the corresponding technical level through learning and through practice, and some of them should be selected to reinforce the scientific research team. Third, step by step some members of the technical force should be pulled from heavy industry and military industry departments to strengthen and improve the S&T ranks in light industry. This can be done either through some workable arrangement of short-term collaboration and joint employment or through various technology transfers or "directed flow of knowledge."

From the academic research point of view, the methodology problem in scientific and technological structure needs to be solved. It is particularly important

to begin establishing a qualitative relationship, even an empirical one, between the economic structure and the S&T ranks in China and determine some reasonable quantitative parameters. These are an important basis for formulating plans and policies. Regarding the micro aspect, when a new enterprise was being established in the past, these parameters were frequently reflected in determining the number of staff based on the scale of the enterprise and the degree of difficulty of the technology. (According to the Ministry of Textile Industry 1963 standard of fixed number of staff, 22.2 engineering and technical personnel were required per 10,000 spindles in the cotton textile industry, and 57 were needed per 100 textile machines in the hemp textile industry.) Regarding the macro aspect, in order to assess the development and planning needs of S&T ranks in 1960, the office of the then central scientific and technological cadre planning group extensively studied the relationship between engineering technical cadres and industrial production value and rate of employee increase for the period 1953 to 1959 in China, and for the period 1926 to 1936 in the Soviet Union. The preliminary conclusion was that for each 100 [percent] increase in the total value industrial production, the number of engineering and technical cadres should be increased by 90 percent, staff and workers by 40 percent, and production workers by 50 percent. This is the most specific parameter we have seen so far.

We should find the method and establish a mathematical model through our own study. Then we can make an analysis of the departmental structure of the Chinese S&T ranks more scientifically than is possible at present.

Footnote: Light industry in this article refers to large light industry, i.e., all industries that produce consumer goods. That is to say, along with systems belonging to the Ministry of Light Industry and the Ministry of Textile Industry, it also includes portions of other industries that produce consumer goods, such as electric meters of the First Ministry of Machine Building and part of the civil products (television sets and semiconductors) of the Fourth Ministry of Machine Building, food and clothing of the Ministry of Commerce, and production departments of some commune and brigade enterprises in the Ministry of Agriculture.

(Edited by Ke Ren [0668 0086])

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STRUCTURAL OPTIMIZATION OF S&T PERSONNEL IN THE CHEMICAL INDUSTRY

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Oct 81, 00 42-44

[Article by Wu Shimin [0702 0013 2404] and He Sheng [0149 3922] of the Science and Technology Bureau, Ministry of Chemical Engineering: "Analysis of the S&T Ranks in the Chemical Industry"]

[Text] An important task in the management of science and technology is the structural optimization of S&T ranks. We have recently made preliminary investigation and analysis of the personnel structure in research units under the direct jurisdiction of the Ministry of Chemical Industry. We wish to present some of our initial views as a reference for study.

I. Ratio of Research Personnel and Support Personnel

To a certain extent, the ratio of research personnel to support personnel reflects the effectiveness of using the research personnel. Although research personnel shoulder the main responsibility of scientific research, they cannot play their role fully without the assistance of a certain number of support staff. According to some foreign studies, support staff can save 30~40 percent of the time unreasonably required of the scientists and increase the results by 50~75 percent. In the chemical research circles in the United States, the ratio of research staff and support staff is approximately 1 : 2.5, and in Soviet Union this ratio is 1 : 3.

In China the scientific research system and management system are different from those in foreign countries, and the research units in industrial departments are also different from those in the Academia Sinica system. For the sake of comparison and discussion, we reviewed the situations in China and abroad and divided the personnel in the chemical industry research units into three categories:

The first category is scientific research staff, i.e., technical staff directly involved in scientific research activities. The second category is support staff, including research management, maintenance, equipment, information, and reference personnel directly supporting the activity of research staff and experimental technicians. The third category is logistics services staff, including staff of administrative management and rear service departments.

Table 1 below shows the personnel composition of some of the research units under the direct jurisdiction of the Ministry of Chemical Industry having 1,000 or more employees.

The data in Table 1 showed two problems:

First, the average ratio of research staff to experiment technicians is 1 : 0.8, so the number of experiment technicians is not quite sufficient. Because experiment technicians are support staff directly engaged in research activity, an insufficient number of experiment technicians invariably forces the research staff to spend a lot of time and effort to do the work originally intended for support staff. Statistics show that many research staff in some units spend one-third of their time every year working as operators in shifts. A systematic training and replenishment of experimental operators for the first line of scientific research is therefore essential.

Table 1.

Unit	1	2	3	4	5	6	Total
Total number of staff	3460	1790	1530	1480	1360	1080	10700
Research staff Number	680	590	520	250	450	360	2850
Percentage of total staff number	20	33	34	18	33	34	29
Supporting staff Number	1620	830	670	420	740	450	4730
Number of experiment technicians included	860	480	280	120	420	220	2380
Service staff	1160	370	340	810	170	270	3120
Ratio of research staff and experiment technicians	1:1.3	1:0.8	1:0.5	1:0.5	1:0.9	1:0.6	1:0.8
Ratio of research staff and support staff	1:2.3	1:1.4	1:1.3	1:1.7	1:1.6	1:1.3	1:1.6

Second, research staff make up only one-third of the staff and workers, and the ratio of main body research staff and research support staff is only 1:1.6 (in foreign countries this ratio is 1: 2～3). An important reason

leading to this discrepancy is the "small but complete" practice for a long time. In foreign countries the supply of scientific instruments and the rear services of daily life have been institutionalized, but in China these are entirely the burden of the research units themselves, and the research units have to assign substantial manpower to these chores; in some cases it takes as much as one-third or one-half of the total number of staff and workers. To change this situation, we must first break away from the "small but complete" situation and gradually socialize the supply of scientific equipment and rear services for daily living. Moreover, production shops not of a research nature should not be in research units. The main avenue to increase income should be a compensated transfer of the research results. Finally, the organizational structure should be simplified, and some of the administrative personnel should be systematically and gradually transferred to research management.

II. Allocation of Research Staff Specialties

In modern scientific research, the collaboration and allocation of many disciplines and specialties are becoming increasingly necessary. Therefore a proper ratio of staff in various specialties should be maintained in the composition of a research team, taking into account the needs in each stage of work on basic research, applied research, and development research. In industrial research units primarily engaged in applied research, it is especially necessary to allocate a certain ratio of engineering researchers.

Table 2 shows the specialty composition of research staff in the Du Pont Company and the Dow Chemical Company in the United States and in some research units in China directly under the Ministry of Chemical Industry.

As can be seen from Table 2, engineers make up a substantial percentage of the research staff in the Du Pont Company and in the Dow Chemical Company in America, respectively 34 percent and 25 percent of their total research staff. In research units directly under our Ministry of Chemical Industry, chemical engineers only make up 9 percent of the total; even combined with mechanical engineers, there are only 20.4 percent engineers, 5~15 percent less than the American companies. As to the ratio of mathematics and physicists, they are two~four times less than in the two American companies. The lack of engineering staff, chemical engineers in particular, is precisely the reason why our industrial research units often lack engineering concepts and why research results often linger in the "sample, display unit, gift" stage and cannot be rapidly put into production. Similarly, the shortage of mathematicians and physicists is precisely the important reason that many industrial research units are unable to develop and apply basic research and cannot improve their research standard.

We therefore believe that, first of all, the institutes of higher learning should include new specialities and train different engineering specialists, and research units should be given the priority to choose from the graduates. Second, some personnel engaged in skilled study should be systematically trained to carry out engineering research. Third, collaboration or joint

Table 2.

Specialization \ Unit	Dupont Company		Dow Chemical		Some institues directly under the Ministry of Chemical Industry in China	
	Number of staff	Percentage	Number of staff	Percentage	Number of staff	Percentage
Number of research staff	3796	100	2000	100	4110	100
Including:						
Chemists	2111	55.6	868	43.4	2378	57.9
Chemical engineers	822	21.8	503	25.3	369	9.0
Medical engineers	468	12.2			468	11.4
Physicists, mathematicians	200	6.0	63	3.1	56	1.4

operation among research units, institutes of higher learning and plants should be highly encouraged so that each can fully develop its advantages and gradually form a science-technology-production consortium.

III. Percentages of Senior, Intermediate Level and Junior Researchers

In other countries, the composition of senior, intermediate and junior researchers in the S&T ranks forms a "pagoda" structure. This type of structure properly reflects the continuity of various levels of researchers and the regularity of advancement and promotion. It also shows the central role played by senior and intermediate researchers.

In research units under our Ministry of Chemical Industry, the structure of senior, intermediate, and junior technical staff is "drum" like, or large in the middle and small at the two ends. Table 3 shows the actual percentages.

Table 3

Total Number of Research Staff	Senior Researchers		Intermediate Level Researchers		Junior Researchers	
	Number of People	Percentage	Number of People	Percentage	Number of People	Percentage
4110	53	1.3	2441	59	1620	39.7

Note: In an actual industrial research unit, a senior researcher refers to a senior engineer, an intermediate researcher refers to an engineer, and a junior researcher refers to an assistant engineer or a technician.

As can be seen from Table 3, the percentage of senior researchers in chemical industry research units is too low. Up to now most of the 16 professions in the chemical industry have not formed their own technological authority or academic leadership. In addition, a great majority of the senior researchers are assigned to leading posts; each person takes on too many jobs and becomes bogged down in administrative duties and cannot develop his technological specialty after losing touch with the actual practice of scientific research for too long.

The structural composition above also reflects the case of an over-concentration of intermediate-level research staff in research laboratories and even in research groups. Because researchers generally have the desire to create the need for self-fulfillment, the excessive concentration of the same level of researchers undoubtedly restricts the development of their intelligence.

We believe that effective measures must be taken as soon as possible to free the senior researchers from the burden of administrative duties and let them return to the first line of research and direct and advise the research. In the meantime, the training and selection of a group of technological point men should be speeded up and an academic and specialty leadership formed. In addition, the policy of personnel exchange should be consistently followed, and some of the overly concentrated intermediate-level researchers should be transferred to departments short of staff so that they can play their role and speed up their achievements.

IV. Age Composition of Research Staff

The age composition of a research team shows the vitality, creativity and the tendency toward prosperity or decline of the team. In the research units directly under the Ministry of Chemical Industry, 96 percent of the researchers have been trained in New China. However, because of the 10-year turmoil, this team has shown signs of aging and lack of continuity. Table 4 shows the age distribution of research staff in these units.

Table 4

Age Interval	Below 35	36-45	46-55	56-60	Above 60
Percentage	14	62	20	8	1

From Table 4 we can see the following features;

First, 62 percent of the research staff are in the best (35-45) age bracket for scientific invention. They have had systematic education in basic knowledge and have gained working ability from 10-20 years of actual practice. They have become the main force in various research units. However, they lack the knowledge of modern science and technology because they have not received timely professional retraining. It is therefore very important to place the emphasis of staff training on these middle-aged staff, whether concerning the present situation or the development of science and technology in the next 10 years.

Second, Table 4 also shows a very small percentage of young researchers--only 14 percent. It has been estimated that 10 years from now the average age of the research staff will be 44, still 2 years older than the present average of 42 even if 5 percent of the current research staff is replenished by new graduates every year beginning in 1981. The number of people in the best age bracket will decrease from the present 60 percent to only 20 percent. We should therefore on the one hand speed up the training of new blood and on the other hand create favorable conditions for the middle-aged and young research staff in terms of learning, working and daily life so that they may prolong their research youth as much as possible.

(Edited by Chen Deyuan [7115 1795 3293])

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MANAGEMENT OF AGRICULTURAL SCIENTIFIC, TECHNICAL PERSONNEL STUDIED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 82 pp 27-30

[Article by Zhu Xinmin [2612 2450 3046] of Anhui Agricultural College: "A Preliminary Study of the Management of Scientific and Technical Personnel in Agriculture"]

[Text] The success of agricultural science research generally depends on three factors: personnel, resources and topics. Among these three factors, personnel has a decisive significance. Technical personnel in agriculture includes research personnel, teaching personnel, technology extension personnel, technical management personnel and technical workers. Their main duties are the research and application of agricultural science technology, the development of agricultural production and the promotion of agricultural modernization. In this article we present a preliminary analysis of the basic situation of agricultural technical personnel in Anhui, explore the main avenues for improving the management of technical personnel in agriculture and seek the basis for readjusting add managing the agriculture technical rank.

I. Labor Results of Agricultural Scientific and Technical Personnel

Technical personnel in agriculture are the pioneers of agricultural scientific knowledge, they engage in a creative effort that plays an active role in agricultural production development. Counting from the early 19th century when agricultural research institutes were first established, European and American capitalist countries have approximately 100 years of history in agricultural science research. Over the last century the development of agricultural science has always been closely related to the development of agricultural production. According to an analysis made by the Americans, agricultural production in the United States increased by 81 percent and production efficiency increased by 71 percent in the 1929-72 period. This is attributed to the promotion of agricultural research and technology. In China the gross value of agricultural production in 1978 was 2.4 times that of 1949, this increase is also closely related to the promotion of improved crop variety and advanced technique. According to statistics of the Chinese Academy of Agriculture, the planting of cross-bred rice and increased fertilizing increased the 1980 national rice production by 7.8 billion jin which is more than 1/3 of the total national increase in grain production. In 1982 China patented the cross-bred rice and for the first time transferred agricultural technology overseas. China

is now exporting to the United States and will be exporting rice to Italy, Brazil, Portugal and Spain to contribute to the world rice production. Anhui Province planted 1.82 million mu of cross-bred rice and production increase due to this practice alone was 270 million jin. In the future there will still be some population increase and farmland will decrease some; it will be more and more difficult to increase the production level and the role played by agricultural technical personnel in production development will be especially significant.

II. Present Status Analysis of Technical Personnel in Agriculture

Anhui Province is an agricultural province with an agricultural population of 88.9 percent. Farm labor and other resources of Anhui are among the 10 highest of provinces in China and yet its production level is not among the 10 highest. Agricultural technical personnel in Anhui therefore have a difficult task to catch up with advanced levels in China and then proceed to achieve modernization. But the current status can be described as not too strong.

Quantity Is Low

(1) Based on the 1978 general survey data, Anhui Province has 9,949 technical personnel in agriculture, this is 7th in the nation and its percentage of the total agricultural population in the province is 2.3/10,000. The national average in China is 3.6/10,000, in Japan it is 18/10,000 and in the United States it is 21/10,000. Comparatively, the ratio in Anhui is on the low side, and in terms of actual need it also appears to be inadequate. On the average each commune has only 3.4. If the 949 science research personnel were taken out, there would be 9,000 left. One-third of those are working in administrative departments of agriculture, forestry and population at provincial, regional or county level. Only 6,000, or two in each commune, are working at ward and commune agricultural technology stations. This situation cannot satisfy the actual need of technology promotion.

(2) There are 949 agricultural researchers in Anhui Province, or 0.23 per 10,000 agricultural population while the national average is 0.27/10,000. These people are distributed in over 100 research units at the provincial, regional and county level, less than 10 in each place. Separately, provincial institutes have about 19, regional institutes about 10 and county units have less than 5. Approximately two-thirds of these people are directly engaged in topical research and, according to the provincial institute of agriculture science, each topic has slightly over two researchers and some of them manage more than two research projects.

Quality Not High Enough and Manpower Not Strong

(1) In terms of education, 60.8 percent of Anhui's science research personnel have college degrees, out of these less than 10 people have graduate degrees; 9.9 percent came from college-level technical schools and 29.3 percent graduated from middle-level technical schools. Separately, 58.2 percent of people

in provincial level institutes have college educations, for regions (municipalities) and counties the figures are respectively 65.2 percent and 59.6 percent.

(2) In terms of technical levels, the provincial institute of agriculture has 2.2 percent of its staff above the level 7, 11.5 percent between levels 8 and 10, 32.4 percent between levels 11 and 12 and the rest 18.7 percent are level 13. In regional (municipal) institutes of agriculture, 8.9 percent are level 9 and 10, 19 percent are levels 11 and 12 and 25.3 percent are at level 13. At the county level, 8.9 percent are of levels 11 and 12, 31.8 percent are of level 13. In Anhui there are very few senior personnel and most of them do not run projects.

(3) In terms of age, research personnel are on the old side and there is a continuity problem. The average staff age at the provincial institutes is 42.7 and 62.3 percent are older than 40. The average age at regional (municipal) institutes is 39.6 and 56.1 percent are over 40. At the county level the average is 37.4 and 43.1 percent are over 40. Principal researchers above the assistant level have mostly passed their best years (25 to 45 years old). Senior researchers in Anhui are older than 70 years, middle-level researchers are over 40 and their average age at the provincial institute of agriculture is 48.1 which is 20 ~ 30 years older than their foreign counterparts. The aging phenomenon is very serious.

(4) In terms of academic leadership, the aging phenomena and knowled[illegible] are relatively acute because of the 10 year turmoil. Authoritative academ[illegible] leadership in research institutes, laboratories and groups has not [illegible] completely taken form and project selection, design, implementation, consolidation and evaluation are in need of strong guidance.

(5) In terms of the basic function of science research, there were less than 40 independent agricultural research units in Anhui before the Cultural Revolution. Now there are over 100 and both the number of institutes and the number of researchers have doubled; more than half of the staff came from other units and departments, a few of them are graduates of the later period of the Cultural Revolution. Therefore, some of the staff lack actual experience in agricultural science experiments.

(6) In terms of personnel structure, there are a total of 3,389 staff and workers in Anhui's agricultural research units. The ratio of administrative cadres, technical cadres and workers is 1 : 2 : 4. In provincial institutes of agriculture the ratio is 1 : 3 : 4, in regional (municipal) institutes the ratio is 1 : 3 : 5 and in county institutes it is 1 : 2 : 5. The figures in Jiangsu Institute of Agriculture and Zhejiang Institute of Agriculture are respectively 1 : 5 : 4 and 1 : 4 : 5. In comparison, there are too many workers and not enough technical cadres. In terms of the specialty and field of the technical personnel, more than 90 percent are in crops, horticulture, sericulture, livestock, aquatic production, and plant protection, 91 percent are in provincial institutes of agriculture, and less than 10 percent are in agricultural economics, mechanical engineering and foreign language. Almost

100 percent of the regional and county institutes are in agriculture. These percentages show that the structure of agricultural technical personnel is not favorable to interdisciplinary combination.

In short, Anhui Province has sizable ranks of agricultural technical personnel and they are relatively active in learning science and technology. If management can be improved to take advantage of the situation, the agricultural technical personnel in Anhui can play a major role in studying and promoting agricultural technology and developing agricultural production.

III. Basic Ways To Improve Personnel Management

The heart of management improvement of agricultural technical personnel lies in the continuous improvement of ability, adjustment of structure and development of the initiative of the technical personnel so that they can be more effective in the process of production development and agricultural modernization. In a sense, the process of agricultural modernization is a process of arming the agricultural workers with science and technology and is also a process of intellectualization of agriculture workers. Quality of the workers is of key importance in improving the productive force in agriculture. Today China is still a country with many illiterates. The intellectualization of agricultural workers should be the whole society's concern and management and use of currently available technical personnel is of decided importance in the intellectualization of agricultural workers and the build-up of agricultural production. Below, we give our unconsidered opinions regarding the improvement of personnel management.

Actively Cultivate Technology Promotion Personnel

Agricultural research units below the provincial level are largely involved with the application and popularization of research results, these units should put more efforts into popularizing research. Provincial institutes of agriculture research should devote 20 percent or more of their efforts on promotion research and popularization activity, regional institutes should put in 50 percent or more and county bureaus should devote their full effort to popularization. At present, technical staff of provincial institutes and region and county bureaus are devoted almost entirely to applied research, about 40 percent of them are doing breeding research. This situation should be changed as soon as possible. Agriculture is under the constraint of nature, arbitrary uniformity over large regions is disadvantageous, the key to popularization is at the grassroot level, communes and brigades. If each brigade were to have an intermediate level technical staff the entire province will need 30,000. If each production team were to have a junior technical staff, the entire province will need 300,000. We can therefore see that training popularization workers and enlarging the technical promotion team is an important task in personnel management. To cultivate promotion personnel we need to open up the avenues for learning, in addition to current colleges and schools, villages should open agriculture middle schools, and research units at the provincial, regional and county levels should also assume the duty of personnel training and serve agricultural production with their research results and personnel output.

Improve the Quality of Research Personnel

Agricultural research in Anhui is primarily bringing in and describing research results, creativity is only secondary. Take seed breeding, for example. More than 40 percent of the effort in the province is devoted to breeding. While only 23.5 percent of the effort is in the use of the seed stock and the selection of promising improved varieties. Furthermore, the planting area is small and relatively few [varieties] are transferred to other provinces. To rectify this situation, the main thing is to improve the personnel quality in addition to improving management. The principal goals of personnel quality improvement are:

(1) Training of academic leaders

Academic leaders are creative and experienced people in the field who can lead a group of people conducting research and development. The average age of 168 intermediate researchers in the provincial institutes is 48.1 years, but the average age of the 50 project leaders of 54 research projects in 1978-79 is 45.3 and 50 percent of them are younger than 45, the youngest one being 34. Thus, it is better to train people younger than 45 as academic leaders.

(2) Training of core researchers

Core researchers should be able to complete assignments independently, organize topical research, design research plans and consolidate experimental work. These core researchers are now all above 40. A group of core researchers should be selected among people younger than 30 and trained to solve the continuity problem.

(3) Improving the fundamental course, experimental technique and foreign language ability of researchers

Because of the aftermath of the 10-year turmoil and the aging of intellectuals, everybody has a retraining and reeducation problem. Everyone should work and learn at the same time with the emphasis properly placed.

In the training and improvement of researchers, the function of currently available academic leaders and senior scientists in each unit and region in the province should be fully developed. There should also be a systematic plan to send people to other units, other provinces and even foreign countries to learn. This effort is of strategic importance and should be implemented systematically and vigorously.

Adjust the structure of the technical rank

First of all, various academic disciplines should be in a proper proportion to facilitate in-depth and general research. In terms of agricultural research units, personnel in basic science, applied mathematics, computer technology, economics, and interdisciplinary fields are now in short supply. We should properly increase personnel in these areas according to the situation in each

unit and the percentage perhaps can be controlled at around 20 percent. Secondly, a more desirable pagoda-shaped structure should be formed through adjustment in the technical level (senior, intermediate, junior), work division (research, assistant, and support staff) and age (old, middle, and young). Third , the ratio of administrative cadre, technical cadre and workers should also be appropriately adjusted. Turn laymen into experienced personnel by training, and gradually use machines to reduce the proportion of workers. The present ratio of 1 : 2 : 4 should be gradually transformed into 1 : 5 : 4, that is, for each management person, there is 1 researcher (or leader), 2 assistants (or core researcher), 2 support staff and 3 to 4 workers.

Thorough implementation of policy and rational use of personnel

Like other technical personnel, agricultural personnel is one part of the worker class and a reliable force of our party. In the past few years the central and local governments have adopted a series of policies regarding agricultural technical personnel which have had the intended effect on mobilizing the initiative of the technical personnel. But there are still some problems which need exploring.

(1) The socialist principle of pay according to work should be adhered to firmly. Today the tendency of average-ism still exists widely among the agricultural technical workers. For units and individuals with prominent achievements in science and technology, the socialist principle of material benefit is not properly realized. In the future, job responsibilities should be made specific, and technical personnel with outstanding achievements should be given timely recognition in terms of political honor, technical job title and work compensation. The same should be done to entire departments to encourage everyone diligently to study foreign languages and fundamental theories and reach for the high peaks of science by investigating and promoting science and technology.

(2) Persist in tailored training and using one's specialty. A research outfit should be a collection of various personnel with research ability. This group should include not only specialized personnel but also general personnel: not only professional personnel but also fundamental and technological talent; not only research staff but also management staff. After a certain basic level is reached, each type of personnel should avoid the use of people with only a layman's knowledge and pretending that laymen are experts.

(3) Personnel flow problems. Personnel flow is conducive to personnel growth and science development. Personnel flow is an objective necessity, if the current job cannot make good use of a person's specialty, be it research, teaching, promotion or management, then transfer may solve the problem. Personnel circulation may be promoted in the following ways: (a) Research institutes should have the right to transfer and hire people; (b) Organize large-scale research collaboration; (c) Invite people in and send people out for professional improvement; (d) Organize visits and academic exchange; and (e) Allow project managers to select assistants and support staff.

(4) Broaden the outlet for talents. The modernization of agriculture needs agricultural technical talents in large numbers, therefore, avenues should be broadly created for talents and only the talents. In addition to cultivating talents through various channels, self-educated youth should also be encouraged. The state should establish the necessary system whereby the self-educated can be examined or evaluated by state appointed units, and after they are hired they should be treated equally. In order to prevent restrictions on talent growth by state regulations, technical personnel and technical cadre may be counted separately and managed separated.

(5) Create a favorable research environment. In order to have a fully effective technical staff, equipment, facility and library material are necessary conditions. Japanese friends recently visited Anhui and their impression of our provincial institutes of agriculture was "nice space but no nice equipment." In recent years the operating expense per person is 2,000 yuan at provincial institutes, 1,500 yuan at regional bureaus and only 1,000 yuan at county bureaus. Take away wages and various sundry expenses, very little is left, and money for purchasing equipment and library material and research project funds are in relatively short supply. If this situation is not changed, it will lead to a waste of talents, and to change this situation we must do two things: one is to increase investment and the other is to cut expenses, increase revenue, maintain priority and invest sensibly.

(6) Establish evaluation and promotion system. The state already has regulations regarding the promotion of technical personnel, but to implement these regulations properly there should also be a system.

In view of the shortage of trained personnel in China and the need to speed up the process, evaluation may be carried out every year to accelerate personnel growth. The main items of the evaluation should include professional standards, foreign language levels, research and work abilities, research achievements and work results, and contribution to and economic effect of agricultural production developments. The mode of evaluation may be a combination of examination, work summary and result appraisal. After the evaluation, proper rewards should be given according to the standard, and promotion to a commensurate technical job title should be made by the academic committee.

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CHINA SCIENOLOGY AND SCIENCE AND TECHNOLOGY POLICY RESEARCH ASSOCIATION ESTABLISHED

Shanghai WEN HUI BAO in Chinese 14 Jun 82 p 1

[Text] At Jiuhuashan in scenic Anhui, more than 100 scienology and science and technology policy research workers conducted a heated debate on a series of important issues concerning China's science development and policy. The China Scienology and Science and Technology Policy Research Association was established here today.

Scienology is a discipline of study of the relationship between scientific and technological development and regulations of scientific research activities on the one hand, and a study of science and technology, social and economic ideology on the other hand. In 1977, the prominent scientists Qian Xuesen proposed strengthening research on scienology. A group of science and technology workers and science and technology policy workers eager to promote scienology research throughout the country began to carry out a study of this field. Now in China, there is the Shanghai Scienology Research Institute and five or six specialized research organizations; 24 provinces and municipalities have established research associations uniting several hundred professional researchers and several thousand amateur research personnel eager to promote scientific research. The Shanghai Railway Institute and other institutions of higher education are offering scienology courses. Scienology and science and technology policy has produced an unprecedented flourishing phenomenon.

For several years, China's scienology research workers have conducted research on strategy for developing China's science and technology, ways of guiding policy and personnel as well as technical and economic proof and feasibility studies on intelligence and scientific research management and important economic and science research matters. They have published articles that have meaning and direction; they have proposed a series of new views, new ideas, and new proposals that have attracted the attention of the Central Committee and some provincial and municipal organs, and have drawn favorable reaction from within and without the country. They have done a large amount of work in researching and popularizing the basic theory of science. The Light Industry Research Institute of Tianjin has utilized scienology theory to improve it's scientific research management, which has enabled it to decrease it's scientific research period by half. For the past three years, they have appraised an average of 10 items a year, of which two to three have met or

appraised an average of 10 items a year, of which two to three have met or approached international standards. This year, in less then 6 months, they have already reviewed six achievements.

This afternoon, the council convened the meeting and elected Qian Sanqiang director, Yu Xueyuan, Qian Xuesen, Li Chang, Tong Dalin, Hu Yongchang, Huang Sui and others to be consultants.

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- END -

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ABSTRACTS

ENGINEERING THERMOPHYSICS

GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS], No 4, Nov 81 30

DEVELOPMENT OF NEW ELECTRONIC PRODUCTS REPORTED

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE & TECHNOLOGY] in Chinese No 4, 1982 p 48

[Report by Wei Yong [3634 3938]: "Brief Reports on Technology"]

[Text] RGS Series Heat Pipe Radiator Apprasied for Production

With the cooperation of the Xian Power Supply Society and the state-run Plant No 877, the Xian Municipal Electronic Instrument Plant successfully developed an RGS-Z series self-cooled heat pipe radiator and an RGS-F wind-cooled heat pipe radiator, which passed technical appraisal in December 1981. At present, heat pipe radiators of two series and over 10 types of specifications (50-1000W) are being batch processed.

The heat pipe is a highly efficient heat-conducting component that appeared in the 1960's and is known as a "near superconductor." A heat pipe radiator is composed of a heat pipe and radiator fins. The heat pipe is itself a near super heat-conducting vacuum device. Its working principle is this: a sealed tube vacuum container is filled with a definite amount of liquid-state working mass, and relying on the process of phase variation it uses the evaporation of latent heat to quickly transmit thermal capacity. Therefore, heat pipe radiators have excellent heat conductivity. They have a high efficiency of heat conduction (heat transmission coefficient is several thousand times that of silver) and a good axial isothermal quality. Consequently they are extensively used.

The heat pipe radiator developed by the Xian Municipal Electronic Instrument Plant is rationally designed and its technical conditions conform to the standard requirements of the defense industry. It has a leading place in the country and can be used as a radiator for high-power crystal tubes, rectifier tubes and silicon controlled rectifiers. In accord with consumer demands, the plant can also supply various types of heat pipes as radiators in sealed mechanical cabinets and transformers or as isothermal devices.

Heat pipe radiators have the advantages of small size, light weight, high efficiency in heat radiation and reliability. They can replace water-cooled units used in electronic equipment and can greatly reduce the size and weight of equipment, while increasing reliability. If used in conjunction with the

high-efficiency heat-conducting grease developed by the Beijing Material Research Institute of the No 7 Machine Department, the result will be even greater.

The Xian Electronic Instrument Plant can directly supply consumers with heat pipe radiators of different specifications. The plant address is: Xiaobeimen wei, Xian Municipality, telephone 6-1823, cable 1823.

SB802 Semiconductor Component Parameters Quick-Testing Instrument

This instrument, which was recently successfully trial-produced by the Shanghai Shanghai Meter Plant, is a new and popular type of semiconductor component parameters multiple quick-testing instrument.

This instrument uses the methods of circuit tests and direct sampling display tests, which can make quick circuit tests of each parameter of the instrument being tested and can simultaneously display all parameters on a fluorescent screen through one scan by the oscilloscope. Test measurement range and test conditions of the instrument are determined by different test inserted parts. It can be used for various parameters of measurement transistors, TTL, CMOS and PMOS integrated circuits and operational amplifiers, with less than 5 percent error. Besides, the instrument has the function of making fixed-point static tests and schematic characteristic curves for each parameter. Equipped with accessories, it can also make quick manual, step and automatic-step tests.

PTV Infrared Heat Television Passes Appraisal Test

The PTV infrared heat television, which was developed by the Huabei Electric Power Power Test Research Institute with the use of the thermal power-releasing camera tube produced by the No 1431 Section of the No 4 machine Department, passed the appraisal test in November 1981. It can quickly and directly display the distribution of surface temperature of a piece of equipment and present a digital display of the temperature of overheated spots. On-the-spot and actual use has proved that it can quickly and visually check and test the trouble of overheating, which basically satisfies on-site needs and contributes to safe generation and supply of power.

Compared to the traditional optical-mechanical scanning thermal imaging system, the infrared heat television has the advantages of requiring no liquid nitrogen refrigeration, low price, being usable in any position and convenient for large batch processing.

Besides its use for a power system, PTV infrared heat television can also be used for energy economization, detection of fire sources, testing laser beams, night vision in battlefield, harmless injury detection and other purposes.

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SINO-WEST GERMAN SYMPOSIUM HELD ON ASTROPHYSICS

Beijing GUANGMING RIBAO in Chinese 18 Apr 82 p 1

[Report by Mao Rongfang [3029 2837 2455]: "Sino-West German Symposium on High Energy Astrophysics Concludes in Nanjing"]

[Text] The 9-day symposium on high energy astrophysics held by the Chinese Academy of Sciences and the Max Planck Society of West Germany ended satisfactorily in Nanking on 17 April. Through mutual contact and academic exchanges, Chinese and foreign scientists have deepened their understanding and enhanced their friendship.

The exchanges in this symposium were rich in substance, including research on neutron stars and other orders of stars, as well as exploration in the areas of galaxies and cosmology. Reports and papers presented at the conference clearly showed that the level of this academic conference was relatively high. West German scientists conducted painstaking theoretical research on close binary stars, catastrophic binary stars and supernovas. They presented information to the scientists present at the conference on the theory on on the accretion of neutron stars. Application of this theory can more satisfactorily explain the phenomena of the radiation of pulsars.

In recent years our scientists have launched research on quasi-stellar objects, active galactic nuclei and compact bodies, accomplished new work in the field of large-scale cosmological structure, and applied the theory of neutrinos having static mass to astronomical research.

The conference received a total of 20 academic papers, and 17 commentary reports were presented. During the period of the conference Chinese and foreign scientists enthusiastically visited the Zijinshan Observatory and the solar tower of the Astronomy Department at Nanjing University.

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APPLIED SCIENCES

ADVANTAGES OF ROCKET-DELIVERED ANTI-TANK MINES DISCUSSED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 7, Jul 82, pp 30-31

[Article by Hua Shan [5478 1472] "Mine-laying Rocket"]

[Text] During a military exercise in northern China last year, waves of missile-like rockets were launched, but they were not ordinary missiles. When they reached a certain point in the air, a series of cylindrical objects were released from the warhead. Under the action of speed-reduction devices, they gradually descended toward the earth, spreading uniformly over a specified area. These were mine-laying rockets, and the cylindrical objects were anti-tank land mines. Once reaching the ground, the mines formed an anti-tank field, which deters the offenses of enemy tanks. Because of the unique features of this exercise, it received considerable attention, and was reported in foreign journals and newspapers.

Why Mine-Laying Rockets?

To understand the importance of mine-laying rockets, let us first discuss tanks and tank warfare. After the Second World War, some countries predicted that the success of future battles would depend on mobility, speed, and rapid adjustment to battle conditions. Battles would be conducted on wide open fields where tanks are the ideal weapons. The tank is a striking force with intense fire-power, high miblity, and heavy armor. In an offensive movement, it is often the focal point for penetrating enemy lines and driving swiftly deep into enemy territory. In a nuclear battle, tanks can move through contaminated areas. Therefore, the tanks has become an important weapon for ground forces to control the battlefield. At present, many countries not only are aggressively developing new tanks, but also have accumulated a stockpile of tanks which more than exceed their defense needs. Consequently, a key issue in winning future battles is how to eliminate enemy tanks in a timely manner.

The traditional weapons for defending against tanks are tanks, anti-tank guns, land mines, and missiles. Anti-tank missiles and guns are highly accurate weapons, but they are inadequate against a large-scale attack. In a large-scale attack, the key is to disable part of the tanks before they reach the battlefield, and to deter the offensive speed, so that there would be enough

time to coordinate all the anti-tank weapons to destroy enemy tanks. The land mine is an effective weapon against tanks; 20 percent of the tanks during the Second World War and 70 percent of the tanks on the battlefields of Korea were destroyed by land mines. But in a modern battle, deploying the mines prior to the battle is no longer appropriate; they must be deployed on a large scale according to the battle conditions and with great speed. There are several methods of rapid mine deployment; by rockets or missiles, by guns, or by aircraft (including helicopters, see the March 1982 issue of this journal).

Advantages of Using Rockets for Mine Laying

The advantages of using rockets to lay mines are as follows: 1) high speed--usually a minefield can be set up in just a few minutes, compared to tends of hours or even days by conventional amnual methods; 2) high mobility--it is not constrainted by terrain conditions, therefore, more opportunities will be available; 3) it can deploy mines deep behind enemy lines, in regions of concentrated enemy firepower, or in regions contaminated by a nuclear explosion; 4) it can rapidly deploy mines along tank routes to intercept enemy tanks and delay their advances; 5) it can be used to confine enemy tanks in a restricted area so they may be destroyed by other anti-tank weapons; in this sense it is not only a defensive weapon but also an effective offensive weapon; 6) since the mines are deployed after the enemy tanks have been committed along their attack routes, not only does the minefield become more effective, but the size of the minefield and the number of mines are reduced compared to conventional minefields, which must cover all possible routes of attack; 7) laying mines using rockets is more economical and safer than using aircraft; and 8) in defense against a large-scale tank attack, it is the most cost effective of all anti-tank weapons.

The disadvantage of rocket mine-laying (which is common to all rapid mind-laying techniques) is that the mines are scattered on the surface and therefore easy to discover and remove. Therefore, anti-tank mines should be deployed in conjunction with anti-infantry mines to produce a mixed mine field, or they should be equipped with time fuses to increase their effectiveness.

Components of a Mine-Laying Rocket

The mine-laying rocket has been part of the weapon development plan of many countries since the 60's; by the 70's, most West European countries had developed new rockets and multi-barrel rocket guns for deploying anti-tank mines and matching equipment. Also some countries had equipped their missiles with "mine-laying" warheads. The U.S. "Lance" missile was one of them.

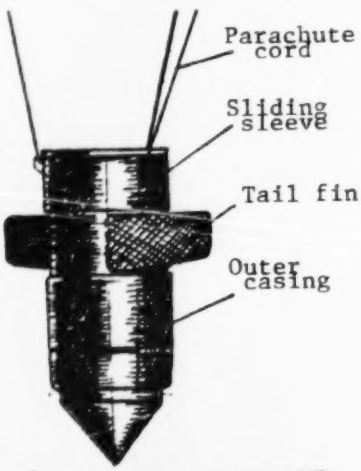
The mines to be deployed by rockets, missiles, cannons, or airplanes must satisfy certain requirements. To meet the requirements of rapid deployment, a new type of mine called the "scattering mine" has been developed. It is powerful, lightweight, small in size, and has a self-destruction mechanism; some are even equipped with an anti-removal device. Its weight varies between 1.5 and 2.5 kg; its diameter is approximately 100 mm, and its length varies

between 300 and 400 mm. It is equipped with powerful explosives, and employs magnetic or sound fusing devices or a pressure trigger fuse for ignition. It can penetrate the treads and bottom armor of a tank; it can also kill the tank crew and set the tank on fire.

In conjunction with the scattering mines, two kinds of rocket cannons and associated rockets were developed. The first kind is a 110 mm 36-barrel light rocket cannon; its range is between 10 and 15 km, and it is primarily used by troops. The rocket weighs approximately 37 kg, and has a 15 kg warhead, which can carry 8 to 10 scattering mines, with a total scattering area of 0.025 square kilometer. The second kind is a medium-size rocket cannon with a range of approximately 40 to 60 km, and is primarily used for regional defense. The rocket weighs approximately 600 kg; its warhead weighs 200 kg, and carries 70 to 80 scattering mines, with a total scattering area of approximately 0.25 square kilometer.

The rocket used by either the light-weight or medium-size cannon has essentially the same structure; it consists of a warhead and a rocket engine. The number of scattering mines contained in a warhead varies depending on the capacity of the warhead and the size of the mines. At the base of the warhead is an electric time fuse and ejector. At a certain time after launch, the electric fuse is activiated, detonating an explosive charge that breaks open the warhead shell; at the same time, the mines are ejected and the parachutes are opened. As the mine descends, the tension on the parachute chords pulls the sliding sleeve upward, exposing the spring-loaded spiral fins inside. Stabilized by the action of the parachute and the tail fins, the mine descends until it plunges into the ground, as shown in Fig 1. When a tank passes over or next to the mine, the non-trigger fuse is activited, igniting the explosives. This generates a high temperature, high pressure jet stream which penetrates the armored plate on the bottom of the tank or damages the treads.

Fig.1 Schematic Diagram Showing the Structure of a Scattering Mine



图一 可散布地雷的结构示意图

In conclusion, we must point out that while rapid deployment of mines by rockets has many advantages, it cannot completely replace other methods of mine-laying, including manual and mechanical means. Also, scattering mines cannot take the place of other types of mines, or other anti-tank weapons. The effectiveness of land mines can be fully realized only if they are used in conjunction with other anti-tank weapons.

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APPLIED SCIENCES

AEROSPATIALE DAUPHIN 2 AEROBATICS EXHIBITION DAZZLES ONLOOKERS

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 7, Jul 82 pp 2-4

[Article* by Xie Chu [6200 4342] "The SA 365N Dauphine 2 Helicopter"]

[Text] On the morning of 6 February, at the invitation of the Chinese Aerotechnology Import-Export Corporation (see article on p 7 of this issue), we drove to the Capital Airport to see a flight demonstration of the Dauphin 2 helicopter.

The Dauphin 2 helicopter is a product of the French Aerospatiale Company in the late 1970's; its French model number is SA 365N. It is a twin-engine, medium-size jet helicopter which has a wide range of applications. It received the French aviation certification in 1981. The helicopter was developed by the Helicopter Subsidiary of the French Aerospatiale Company, which incorporated many new technologies of the late 70's. Therefore it is representative of the current state-of-art in helicopter technology, and its performance is considered to be superior among similar products on the world market.

Adaptation of Dauphin Manufacturing Technologies

Two years ago, this reporter learned that the Chinese Aerotechnology Import-Export Corporation (CAIEC) was considering adapting a new helicopter manufacturing technique from abroad. The company conducted an investigation in which detailed analyses and comparisons of some of the more advanced helicopters in the world were made; they also sent delegations to various helicopter manufactureres in the United States and France. As a result of this investigation the Dauphin 2 was selected. In July 1980, CAIEC signed a contract with the French Aerospatiale Company to transfer the Dauphin 2 manufacturing technology. The contract specified that France would transfer all technologies required to build this helicopter and its engines to China. Initially, France would provide two complete helicopters to be assembled in China; then France would supply only some of the parts, and finally all the parts for the helicopter and the engines would be built and assembled in China. During this period

* For additional material on the SA 365N Dauphin 2, see JPRS 81180, China Report/Science and Technology, No 165, 30 Jun 82, pp 23-28

of cooperation, France would help Chinese technicians master all the necessary techniques for building the helicopter as well as the engine. The two parties also agreed that China would sell a certain quantity of helicopter parts back to France as partial compensation for the technology transfer. This contract was approved by both governments and became effective in 1980.

The Dauphin 2 received considerable attention because it was the first adaptation of foreign helicopter technology in 20 years--since the M-4 helicopter in the 50's. With the help of a comrade who participated in the helicopter inspection and selection process, this reporter was allowed after signing of the contract to read all the pertinent information in order to understand the reasons behind the selection and the characteristics of this helicopter. In addition to the written information, now he was given the opportunity to see the helicopter in person. Upon arrival at the Capital Airport, we were taken to a lounge where Chinese and foreign guests attended an introductory briefing and watched a French movie about the Dauphin helicopter. According to this introduction, the Dauphin 2 is a multi-purpose helicopter. By adapting more than 50 selected pieces of equipment, the French Aerospatiale Helicopter Company can modify the basic helicopter into different models for different applications. For example, it can be used to transport personnel between the mainland and off-shore oil drilling platforms; it can be used for geological exploration, aerial photography, forest fire prevention, field rescue, installation of high voltage power lines, and coastal patrol; it can also be used to serve as a short-range passenger carrier along a route where ground transportation is not readily available. In addition, the French Aerospatiale Company is developing a military model of the Dauphin helicopter which will serve as an anti-tank vehicle or troop carrier, and perform such functions as reconnaissance, ranging, and ship-based operations. Because the rotor blades of the Dauphin are made of corrosion-resistent composite materials, it is particularly sutiable for applications at sea.

After the movie, all the guests were invited to the airfield to see the flight demonstration.

Flight Demonstration of the Dauphin Helicopter

A strong wind was blowing on the airfield, but the flight demonstration processed as scheduled. There was a large number of spectators, including many guests from France: the French ambassador, the chairman of the French National Bureau of Aviation, and the president of the French Aerospatiale company.

Glittering under the sun was a streamlined helicopter painted in white with red and blue stripes. Unlike conventional helicopters, its tail rotor is embedded inside the large vertical tail. This type of culvert tail rotor design not only eliminates the need for an intermediate speed reduction unit, but also provides additional safety. During ground operation or low-altitude flight, the pilot need not worry about the rotor blades injuring people or hitting trees.

An accident caused by a tail rotor happened on 2 March of last year, when an Mi-8 helicopter of the Egyptian Air Force developed engine trouble during take-off, and the tail rotor caught a dangling power line. The helicopter

immediately went out of control and hit a pole nearby; it fell to the ground and burned, killing all passengers on board, including the Minister of Defense and more than ten high-ranking military officers.

The cockpit and passenger cabin of the Dauphin have large windows which provide good visibility. On top of the fuselage are two "Arriel" 1C turbo-axle engines. This engine was developed in the late 70's; it is light-weight, compact, and has relatively low fuel consumption. Each engine can deliver up to 700 hp.

The Dauphin helicopter used in the flight demonstration was the first complete helicopter received from France. It was first flight-tested and certified in France, and then disassembled for shipping to this country. It was then re-assembled in Beijing to take part in the flight demonstration. The flight crew of today's demonstration consisted of both Chinese and French pilots. The pilot and the engineer were French and the co-pilot was Chinese.

At 9:30 am, the ground commander issued a start signal. Accompanied by the roaring sound of the engines, the four rotor blades began to rotate rapidly. Supported by its tricycle landing gear, the Dauphin glided over the runway, and then lifted off. First it climbed rapidly, then it dove in front of the review stand and cruised by at an altitude of only 50 meters. With the landing gear retracted, the helicopter has a clean, aerodynamic shape with very low air resistance. Because of the low-drag aerodynamic design and light structural weight, the Dauphin 2 can reach a maximum cruising speed of 293 km per hour. This is 10 to 20 percent faster than similar jet-propelled helicopters such as the U.S. Bell 212/412; and 30 to 40 percent faster than piston engine helicopters such as the Soviet M-4.

Right before us, the Dauphin climbed upward along a steep slope, then turned into a dive (maximum speed during a dive can reach 324 km/hr), and passed over our heads. Again, it climbed upward and made a turn before it slowed down and hovered in midair. While hovering, it was able to move sideways to the left and to the right, and also rotate rapidly in the same spot. Suddenly, it started to climb vertically to an altitude of 400 m; then it dove straight down, and as the spectators whispered with awe, it glided sideways and landed on the runway.

Although the demonstration only lasted for a short time, the spectators were able to observe 20 to 30 different flight maneuvers. The smoothness of these maneuvers clearly demonstrated the high degree of mobility of a modern helicopter.

Successful Application of Composite Materials

After the demonstration, we all approached the helicopter and gave our congratulations to the pilots who were emerging from the exist door. They opened all the doors to the cockpit and the passenger cabin for us to inspect the interior of the helicopter. The main body of the Dauphin helicopter makes extensive use of composite materials; 59 percent of its structure is made of composite materials wereas ordinary aluminum alloy riveted structures account for only 13 percent. As a result of extensive weight reduction measures and improved design efficiency, the take-off weight of the helicopter is only

3,850 kg, but its effective payload can be as high as 1,810 kg. In comparison, the M-4 has approximately the same effective payload, but its maximum take-off weight is almost twice as large. According to the reporter's observation, the Dauphin is only two-thirds the size of the M-4, but the capacities of the two cabins is approximately the same. In addition to the two pilots, the Dauphin can accomodate 12 passengers; also, there is a luggage room in the rear. According to the pilot, because of its light weight and small drag area, the Dauphin is not only fast but also economical. The fuel consumption of the Dauphin is approximately 1 kg per km; the U.S. Bell 212/412 helicopter consumes approximately 1.5 kg per km. The pilot is also satisfied with the control of the helicopter. Although the control system is rather complicated, once having mastered it, he can operate the helicopter with ease. However, he did comment that the stability of the Dauphin can be further improved because it tends to wobble when a gust is encountered.

One of the outstanding features of the Dauphin is that the rotor blades are made of composite materials and the star shaped flexible blade housing made of fiberglass. The rotor has four blades made of glass cloth and carbon fiber; the diameter of the rotor is 11.93 m. The leading edge of each blade is covered with a stainless steel shield for protection against debris during take-off and landing. A composite material rotor has the advantage that any mechanical injuries such as cuts and dents will not cause fatigue damage; its useful life can exceed 5,000 hours. The star-shaped flexible blade housing does not require lubrication; its structure is simpler and has fewer parts than ordinary metallic housing. Therefore, it is easier to maintain, and provides safer and more reliable service. Furthermore, the structural design of the rotor blades and blade housing is such that vibrations during flight are reduced. This not only improves passenger comfort but also prolongs the useful lives of parts and instruments on the helicopter.

This demonstration and inspection of the Dauphin 2 left us with a deep impression. According to the comrade of CAIEC, adaptation of of foreign technologies not only will help us learn the most advanced technologies in manufacturing helicopters, but also provide us with the capability to build high performance medium size helicopters for economic construction. At the same time, adapting foreign technology for domestic production will save considerable foreign exchange compared to purchasing the helicopters from abroad.

The Future of Domestic Helicopters

As our car left the Capital Airport and returned to Beijing, this reporter's thoughts drifted from the Dauphin to future domestic helicopters.

The helicopter is an essential vehicle for economic and defense construction. The number of helicopters produced has increased dramatically during the last decade; helicopter technology has also been improving continuously. In particular, the requirement of off-shore petroleum development has stimulated the production of helicopters for oceanic operation; advance in tactical missile technology has motivated the direct use of helicopters in battles, and the problem of hardening helicopters is receiving an increasing amount of

attention; also, increasing emphasis of anti-submarine warfare has placed heavier demands on ship-based helicopters. During the recent struggle for the Malvinas Islands between England and Argentina, both sides used missiles launched from helicopters to attack enemy ships. This is a good example of the effectiveness of helicopters in modern warfare.

Since the 50's, the helicopters produced in this country have been primarily the V-5, which is an adapted version of the M-4. This helicopter has played an important role in transportation, mineral exploration and forest protection, elimination of farm insects, military training, and rescue operations, etc. In 1966, after the strong earthquake which hit the Jin-Tai region of Hubei province, this reporter flew on one of the V-5 helicopters sent by the Air Force to villages near the center of the earthquake, and reported on the moving scenes of local militia using helicopters to ship critically injured victims. At that time, many roads and bridges were so badly damaged that motor vehicles could not get through. In some villages where all the houses had collapsed, the only way to move the injured to a nearby hospital was to land helicopters in a field next to the village. Each helicopter can carry eleven to twelve people (see the article "A Flight With Class Sentiment" in the May 1966 issue of this journal). Even though the pilots were constantly subject to vibrations and noises, they rarely took time off for rest. As soon as the injured were unloaded and the fuel tanks were refilled, they took off to another village. Without helicopters, many lives of the injured victims would have been lost.

Now in the 80's, the technologies of the V-5 have become obsolete. The newly adapted Dauphin has the same payload as the V-5, but its performance is superior to the V-5 in terms of range, speed, and reliability. Clearly, it is a good replacement for the V-5 as a medium-size multi-purpose helicopter.

However, to cover China's vast territory and to accomplish the difficult missions of socialist construction ad national defense, only one type of domestic helicopters is clearly not adequate. We hope that in the near future, more and better Chinese-made helicopters will be seen in the sky to satisfy the many needs of the people.

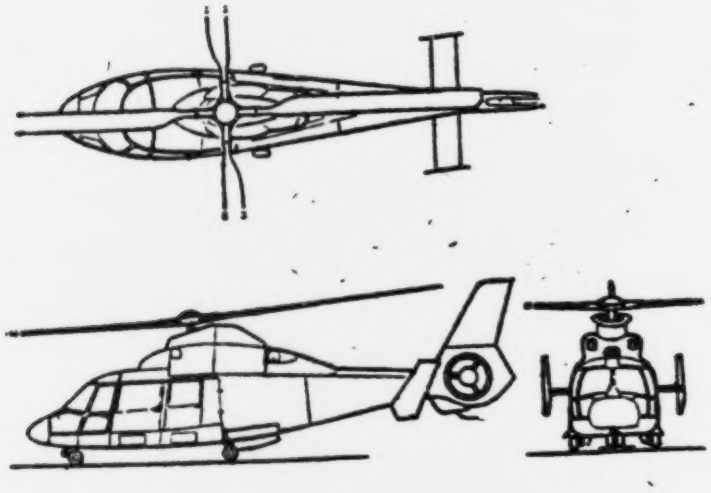

Fig. 1 The Three Views of Dauphin SA 365N

The specifications of this helicopter are as follows: rotor diameter 11.93 m, length 11.44 m, height 4.01 m; maximum take-off weight 3,850 kg, effective payload 1,810 kg, maximum external load 1,700 kg; maximum speed 306 km/hr, maximum cruising speed 293 km/hr, crusing speed 260 km/hr, maximum range 880 km, fuel capacity 1,140 liters.

3012
CSO: 4008/203

APPLIED SCIENCES

NATIONAL AEROTECHNOLOGY IMPORT-EXPORT CORPORATION EXPANDS BUSINESS BASE

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 7, Jul 82, p 7

[Article by Hang Yan [2635 1484]]

[Text] During a trade fair in the fall of 1979, the National Aerotechnology Import and Export Corporation (NAIEC) for the first time put on display a group of unique mechanical and consumer products such as commercial airplanes, motorcycles, and precision equipment and tools. The high quality and sophisticated technology demonstrated by these products attracted a great deal of attention from foreign businessmen.

With the increasing market demand, NAIEC has been steadily expanding its business base. Currently it handles aviation products such as airplanes, engines, flight instruments, electrical devices, accessories, and parts. It also handles non-aviation products such as precision machine tools, numerically-controlled lathes, precision test equipment, motorcycles, bicycles, medical equipment, baking and drying aparatus, optical machines, various engineering measuring tools, cast and forged parts, electronic and electric products, and parachutes, etc. Because of the insistence on quality, many of the products handled by NAIEC have established a good reputation on the international market. These products include: rulers, meters, granite platforms, gage blocks, drill bits, fibers, filing tools, knives, pliers, and magnetic platforms, etc. The export volume of these merchandise is quite large; some of the items are in such high demand that the supply can hardly keep up. The Chinese-made model airplane engines which broke three world records have also become big export items.

In order to further these products and to renovate the aeronautical industry, a number of export bases are being established. For example, a "NAIEC Industrial and Trade Center" located in the Shenchuan financial district is now under construction. Several factories in the Center, e.g., the Nanhang Electronic Factory, the Aluminum Processing Plant, and the Shenchuan Aeronautical Precision Model Factory which was built with foreign investment, have started production.

NAIEC is also involved in architectural design projects, particularly in blueprint preparation and modification. This type of work is attractive to Western countries because of the availability of large labor force and high technical standares. Within a year, NAIEC has signed contracts with a number of companies abroad.

To improve the quality of products, aeronautical and related industries in this country have made significant achievement by learning from the experiences of advanced nations abroad, conducting technical training classes, and by implementing specific technological innovations. Some industries have received certification from companies abroad for meeting the quality-control specifications in the contract; others have developed products rated by foreign companies as being of "superior quality."

With the increase in foreign trade, NAIEC has established subsidiaries in Guanzhou, Fuzhou, Shanghai, and branch offices in Shenchuan and Xiameng. It has also set up liaison offices in London, Bordeaux, Marseille, and has established economic and technological cooperative programs with factories and businesses in more than 40 countries. In 1981, NAIEC improved its trade efforts by inviting foreign businessmen to China and sending sales representatives overseas to advertise its products. A total of 15 trade delegations were sent to the United States, England, West German, Japan, Italy, Sweden, Portugal, Argentina, Thailand, and Hong Kong to engage in advertising and trade activities. In addition to participating in the twice-yearly trade fairs, NAIEC also sponsors exhibits of aeronautical cast and forced parts to allow foreign businessmen to further understand the production capability and technical standards of China's aeronautical industry. As a result of the frequent business contacts, an increasing number of people have initiated business negotiations with NAIEC.

At present, NAIEC is in the process of improving its foreign trade system. Since 1980, the foreign trade management policy has been undergoing changes in an attempt to motivate various industrial personnel to promote export trade and foreign exchange. The basic change involves the assurance that each industry would benefit from its contribution to increased export and foreign exchange. Under the general guideline of complying with national plan and providing a unified front, each industry can increase its export quota and enjoy the return from its share of foreign exchange. The important products are exported collectively by NAIEC, but industry representatives have the right to participate in negotiations with foreign merchants. For general products, each industry is responsible for the sales as well as profits or loss, and NAIEC serves as a management agency. For certain products that have good market potential but are easily separable such as cast and forged parts, tools and hardware, special associations have been set up for the purpose of conducting market research, coordinating, and providing guidance to basic production units. In addition, effective policies and regulations have been established to improve quality control and to provide technical service, so that foreign trade and export activities may be further developed.

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PLANS FOR MECHANICS SOCIETY'S ACADEMIC ACTIVITIES ANNOUNCED

Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese No 2, 1982 pp 72-73

[Article by correspondent of this magazine: "Plans for Academic Activities of the China Mechanics Society in 1982"]

[Text] 1. Fatigue Discussion Meeting: In October 1982, the China Mechanics Society will cosponsor this meeting with the China Aviation Society. The agenda of the meeting will include fatigue damage, expansion of fatigue cracks, fatigue statistics and reliability analysis, fatigue load spectroscopic tests, counting methods, methods of compiling spectra, fatigue property tests, and study of the mechanism of fatigue destruction.

2. Discussion Meeting on Calculations for Structural Dynamics: This meeting will be held at Chungqing in the 4th quarter of 1982. The content will be to discuss the activities for that profession, major problems and research methods.

3. Exchange Meeting on Weighted Residuals Method: The meeting will be held in May 1982 at Xiamen. The content will include theoretical research and application of the weighted residuals method used in mechanics of solids, and the comprehensive utilization of that method with other methods.

4. Third Academic Conference on Structural Mechanics of Reactors: The meeting will be held in October and November 1982, at Beijing. The content will include problems in the mechanics of nuclear reactor structures, their computation, experiments and tests.

5. Second National Composite Materials Academic Meeting: This meeting will be held in August 1982, in Harbin. It will be jointly sponsored by the Mechanics Society, the China Space Flight Society and the China Aviation Society. The content will emphasize advanced composite materials, including the mechanical properties of composite materials, their strucutral mechanics, nonlinearity, visco-elastic properties, plasticity, visco-plastic properties for analysis in mechanics of materials, wave propagation and the finite method, numerical method in structural analysis, breaking and fatigue of materials, analysis and design for connecting composite materials, structural design, computation and optimization, testing and research.

6. Third National Experimental Stress Analysis Academic Conference: This will be held in the 3d quarter of 1982 in Sichuan. The content includes new

progress in the measurement of scattered spots of interference in holography and new developments in the cloud streak method, basic methods of photoelasticity and its application in new realms of mechanics (biomechanics, mechanics of breaking), electrical measurement technology under special conditions, data collection and processing, application of experimental stress analysis in engineering, especially in the development of energy resources and energy conservation. The conference will have a small exhibition to display new scientific research achievements, instruments and equipment, materials and components.

7. Academic Conference on Physical-Chemical Flow, Multiphase Flow, Non-Newtonian Fluid Mechanics: This conference will be held in April 1982, in Beijing. The content will explore and exchange information on theoretical research, experimental research and applications research in other related realms.

8. Conference on Computational Fluid Mechanics: This meeting will be held during the 2d quarter of 1982 in Chengdu. It will be jointly sponsored by this society and the China Aerodynamics Research Society. The meeting will discuss the computational methods in fluid mechanics, the calculation of flow in circular flow problems, hydromechanics, wave motion of gases, river and ocean and atmospheric mechanics, magnetic fluid mechanics, biological fluid mechanics, space aerodynamic mechanics and calculations in fluid mechanics for other engineering projects.

9. Conference on Fluid Mechanics of Percolation: This meeting will be held during the 3d to 4th quarter of 1982, at Lanzhou. It will discuss theoretical research in percolation, experiments and test studies and testing techniques and their application in the national economy.

10. Academic Conference on Flow Stability, Turbulence and Boundary Layers: This meeting will be held in October 1982. The content will include the study of flow stability and turn-about phenomena in various fluids (including gas, water and other media), even isotropic turbulence, shear turbulence (such as jetstreams, tail streams, free mixture layers and others), the basic theory of these branch sciences such as the boundary layer of fuilds, semi-impirical analysis, numerical calculations and experimental measurements.

11. Academic Exchange Meeting of First Flow Spectroscopic Display Technology: This meeting will be held during the 2d quarter of 1982, in Xiamen. The content will include the method of display, the use of new equipment in reasearch such as the method of external addition of materials and optical methods, image recognition and calculations for quantitative analysis, analysis of three-dimensional flow fields and holographic interference, and the application of display techniques in various fields.

12. Learning Class in Gas-Solid Phase Fluidics: This will be held in July 1982, in Harbin. The book "Fluid Dynamics of Multiple Phase Systems" by Su Shaoli [5685 4801 4409] will be translated by chapters as class preparation. Participants will be allowed to speak and will hold collective discussion. This year, chapter 5 will be discussed.

13. Discussion Meeting on Flow Stability: This meeting will be held in the 4th quarter of 1982 to explore the theory of flow stability and its control.

14. Academic Meeting on Soil and Rock Blasting: This will be held during the 2d quarter of 1982. The content includes detonation theory, various types of detonation techniques (such as shallow holes, caverns, underwater, deep holes, smooth surface, precracking, pressure resistance, safe blasting) and means of observation, development of cheap explosives, and safety techniques in blasting.

15. Academic Conference on Explosive Processing: This will be held during the 2d quarter in 1982. It will discuss explosion of industrial dynamites, the effect of shock waves on the properties of metals and the structure of metals, pulverized metal forming, explosive welding, explosive cutting and explosive hardening, explosive forming and other equipment.

16. Academic Conference on Nonlinear Mechanics: This will be held in the 3d or 4th quarter of 1982. It will explore the nonlinear theory and its computational research.

17. Discussion Meeting on Cardiovascular Dynamics: This will be held in the 3d quarter of 1982 at Xiamen. It will introduce current research in cardiovascular dynamics at home and abroad and achievements will be exchanged.

18. Discussion Meeting on Mechanical Properties of Rocks Related to Earthquakes and the Interior of the Earth and Mechanical Mechanisms of Earthquake Indications: This will be held during the 3d quarter of 1982 to introduce the work at home and abroad and to exchange achievements.

19. Discussion Meeting on Civil Engineering: This will be held in the 4th quarter of 1982. It will combine the discussion with an actual project to discuss rock engineering mechanics and stress distribution in the region.

20. Reading Class in Soil Mechanics of Critical States: This will be held from September to October 1982. The content will mainly include the σ - 8 of the basic knowledge of the theory of elastoplasticity and strength patterns.

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CONFERENCE ON MACHINERY HEAT TREATMENTS HELD

Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 4, 1982 inside back cover

[Conference notes: "Activities of the Society and the Profession"]

[Text] The National Light Industrial Machinery Nitrogenation Field Conference was held from 12 to 19 October 1981, in Shanghai. Attending the conference were 110 delegates from 23 provinces and cities. During the conference, there were special reports, exchange of experience, special subject lectures, on-site demonstrations, and the delegates were organized to conduct metallic phase sample making and test analysis. Good results were realized. The conference discussed the key points in heat treatment work for light industrial machinery in the future: Further to grasp well the reorganization of the enterprises, improve the level of business management, exert efforts in stabilizing and improving the quality of heat treatment; coordinate efforts closely with the products to elevate their grades and to create superior products and to overcome difficulties; draw up plans to improve heat treatment techniques, exert key efforts to improve product quality, energy conservation, labor conditions, and economic gain; strengthen the means of testing, conduct technical training according to plan, gradually establish a backbone team in heat treatment techniques for light industrial machinery, and actively utilize new technologies according to the characteristics of each plant.

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CSO: 4008/177

DEVELOPMENT OF DIRECTIONAL SOLIDIFICATION TECHNOLOGY IN CHINA

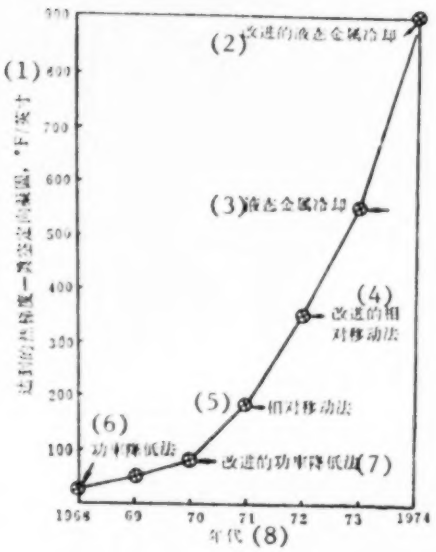
Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 5, May 82 pp 39-43

[Article by Xue Yanlu [5641 1693 4389]*]

[Text] During the mid-1960's, Pratt and Whitney of the United States successfully developed directionally solidified high temperature alloys and turbine blades. This has attracted the attention of all nations of the world. The Beijing Aviational Materials Research Institute was the first to develop such research in 1968. Later, some research institutes, schools and factories followed and all realized definite achievements. For more than a decade, China has built a technical team with a definite technical standard in this aspect. They have remodeled, designed, manufactured and introduced some directional solidification equipment, developed the power drop method, the high rate solidification method and the liquid metals cooling method and other such processes of directional techniques. They have successfully developed some directionally solidified alloys and produced many types of directional turbine blades for aviation engines. Some have been factory tested and some have been tested in flight and they have passed evaluation by the state. These research achievements have actively pushed forward the development of our nation's aviation industry and at the same time provided favorable conditions for producing engines with a high thrust ratio and long life. This article is a brief introduction to the present development of directionally solidified turbine blades in our nation.

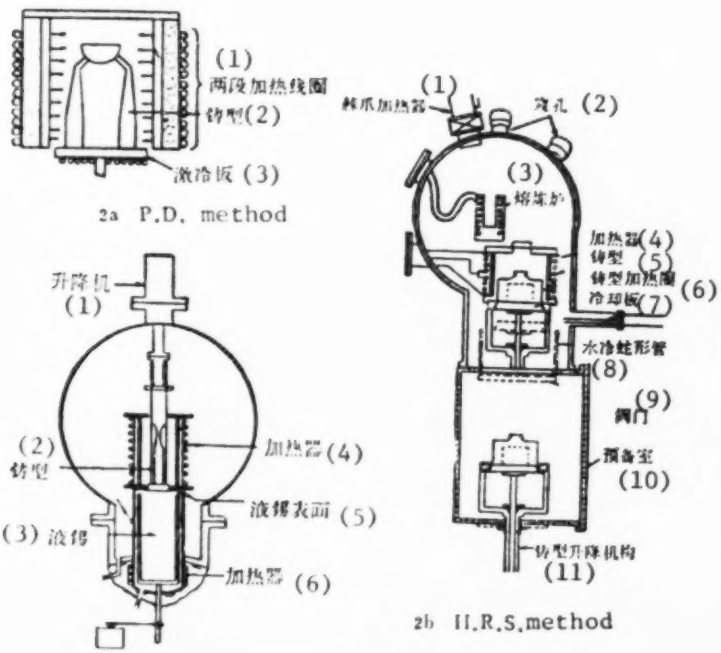
I. Directional Solidification Technology and Facilities

1. Directional Solidification Technology. The development of directional solidification technology in our nation went through a gradual development from the simple to the complex and from low grades to high grades (see Figure 1). At first, the relatively simple power drop method was used. Equipment was remodeled from ordinary vacuum induction furnaces. The characteristics of this technology are as follows: The casting mold heater has two sections. After pouring, the power is gradually reduced and the casting model remains stationary throughout the solidification process. The directional solidification of the cast is completed mainly by heat conduction through the water cooled crystallizer at the bottom (See Figure 2). Because this method has a small temperature gradient, the speed of solidification allowed is low, therefore productivity is not high, the direction of the pin crystals is scattered and



Key:
(1) Heat gradient-vacuum directional solidification reached, F/inch
(2) Improved liquid metal cooling
(3) Cooling of liquid metal
(4) Improved relative shift method
(5) Relative shift method
(6) Power drop method
(7) Improved power drop method
(8) Year

Figure 1. Course of Development of Directional Technology in Our Nation



Key:
2a P.D. method
(1) Two-stage heating coil
(2) Casting mold
(3) Stimulated cooling plate
2b H.R.S. method
(1) Pawl heater
(2) Observation hole
(3) Smelting furnace
(4) Heater
(5) Casting mold
(6) Heating coil of casting mold
(7) Cooling plate
(8) Water cooled S-pipe
(9) Valve
(10) Preparatory chamber
(11) Casting mold elevator
2c L.M.C. method
(1) Elevator
(2) Casting mold
(3) Liquid tin
(4) Heater
(5) Liquid tin surface
(6) Heater

Figure 2. Illustrations of the Power Drop Method, the High Rate Solidification Method and the Liquid Metal Cooling Method

the pins are not tall and straight. The structure and properties of the top and bottom blades with a length of less than 150 millimeters and it cannot satisfy the demand for producing long blades of superior quality. To satisfy the needs in the development of our nation's aviation industry, the high rate solidification method was developed in the 1970's. The characteristic of this method is that after the cast is filled with liquid metal, the liquid metal is removed slowly from the casting heater. The dispersion of heat when the alloy solidifies not only relies on heat conduction of the crystallizer at the bottom, it also depends on heat radiation from the cast to the surroundings (see Figure 2). Therefore, its temperature gradient is greater, the rate of solidification allowed is faster, and productivity is higher. Also, this method is favorable to the strict control of technological parameters. The directional deviation of the pin crystals of the cast is small and the structure and properties of the top and bottom parts are more consistent. Now, we can produce blades of 220 millimeters long and plates of 250 millimeters long (see Figure 3).

Figure 3. DZ-22 Alloy Plate Poured by the High Rate Solidification Method

As experimental research work continues to deepen and as technology continues to be perfected, the control of various technological parameters has become more stringent. Compared to data published in foreign nations, it can be seen that the current technological parameters in our nation are basically the same as those of foreign nations (see Table 1).

Table 1. Comparison of Current Technical Parameters in Our Nation and Foreign Data (results of thermal analysis)

Parameters		Power drop method	Low rate solidification method	Improved high rate solidification
Temperature gradient G,	A	10 - 15	20 - 40	--
C/centimeter	B	8 - 16	19 - 27	16 - 32
Rate of solidification	A	5 - 10	20 - 30	--
R, cm/hour	B	40 - 120	100 - 200	100 - 55
Width of mushy	A	12	3	--
area ΔX, cm	B	3 - 6	2 - 2.7	≤ 2
G/R value,	A	1.5 - 2	1 - 1.3	--
°C.hour/cm^2	B	0.05-0.3	0.3 - 0.7	0.2 - 0.6

Remarks: A Data published abroad
B Data of the Beijing Aviation Materials Research Institute. The data are the results of thermal analysis conducted for the parts poured in the remodeled directional solidification furnace.

In addition, China has also developed the liquid metal cooling method. The characteristic of this method is that the cast filled with poured metal is directly submerged in liquid metal of a low melting point for cooling (see Figure 2). Because the temperature gradient is even larger and the speed of solidification allowed is even higher, therefore the quality of the cast is good and productivity is high. Especially worth mentioning is that our nation has already developed a type of metal cooling agent with a melting point of only 5 to 15°C to replace commonly used tin which has a melting point of 238°C. The agent can be used under normal temperatures and complex cooling equipment is not needed. This not only elevates the quality of the cast, it will also visibly push forward the study of directional alloys and cocrystalline alloys. But this technology requires continuous production facilities and its economic characteristics have to be solved further.

2. Directional solidification equipment. To satisfy the needs in the research of directional solidification technology and the production of directional blades, our nation began as early as the 1960's to design and manufacture a directional solidification furnace that can automatically control its temperature and that can serve continuous production (see Figure 4).

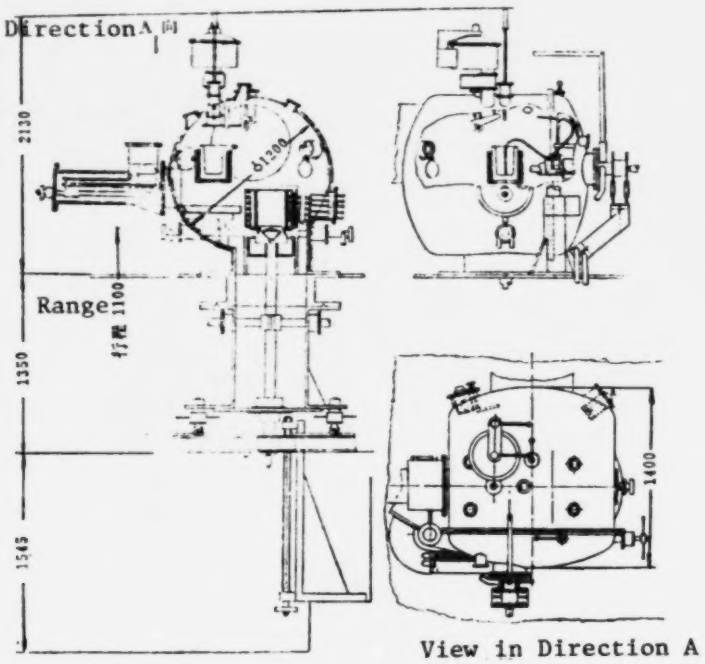


Figure 4. Directional Solidification Furnace Designed by Ourselves (unit millimeter)

Its major technical parameters are as follows:

Body of furnace: horizontal (melting chamber, pouring chamber, horizontal feeding chamber)
Melting and shell heating temperature: 1700°C
Maximum degree of vacuum: 5×10^{-4} millimeters mercury column.
Air leakage rate ≤0.5 micrometer/minute
Rate of rise and fall of crystallizer: 2.5 to 20 millimeters/minute.
Fast speed: 50 to 400 millimeters/minute.
Speed of spin of crystallizer: 1 to 5 revolutions/minute.

In recent years, China has imported the 5241-2D/S-A model directional crystallization furnace from the Vacuum Engineering Industries Ltd. of the United States and the IPS^2 /III-DS model directional crystallization furnace from the Leyboed-Heraeus Company of West Germany. Figure 5 shows the ISP^2 /III-DS model directional crystallization furnace that has already begun production.

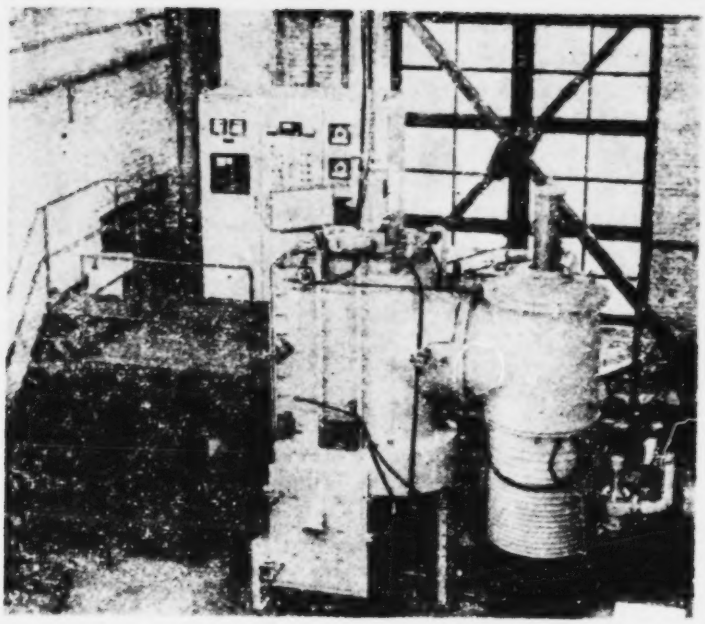


Figure 5. The ISP^2/III-DS Model Directional Solidification Furnace That Has Already Begun Production

II. The Mold of Directional Porcelain Shell and the Core of the Porcelain Mold

1. The Shell Mold. The shell mold used for directional solidification is different from that used for ordinary fine casting. First, the single shell used for directional solidification must retain its strength for long periods (>40 minutes) under a temperature reaching 1,550°C when overheated and melted metal is poured into it. Second, in directional solidification, the temperature difference between the top and the bottom parts of the casting mold is very large (generally about 100°C to 1,650°C). Therefore, the load softening point of the shell mold must be high and the thermal stress sensitivity must be low. The shell must not split open, it must not deform, and it must not produce mold cavity reactions. To satisfy the above requirements, we have developed many types of shell mold materials and shell manufacturing techniques. At the beginning we used ordinary ethyl ester silicate-corundum series shell molds but we did not obtain satisfactory results. At the beginning of the 1970's, we began studying shell molds of the silica sol-aluminum vanadine [alumina] series. These types of shell molds have good high temperature strength and resist deformation. The technique is simple. Many types of directionally crystallized blades for aviation engines were poured using this type of shell molds (See Figure 6). Because aluminum-vanadine has a better heat conductivity, it can adjust the temperature distribution in the interior

of the mold cavity in time when the metal solidifies and it can make the pin crystals grow thin, long and straight. But, aluminum-vanadine contains impurities and pollutes the surface of the castings. At the same time, the quality of the raw material of aluminum-vanadine is difficult to control. Sometimes, the castings are abandoned because the quality of the shell mold is poor. These all need to be further solved. In recent years, we have also successfully developed a new shell mold material for directional solidification and new shell mold material for directional solidification and new shell manufacturing techniques. This new shell mold has a high strength under high temperatures, deformation is small, stability is good, and these properties have surpassed those of all the shell molds used in the nation at present, and they have created favorable conditions for production of directional nonresidual blades (Figure 7 shows the new shell mold ready for pouring for directional solidification). Table 2 lists the chemical composition of aluminum-vanadine and its physical properties.

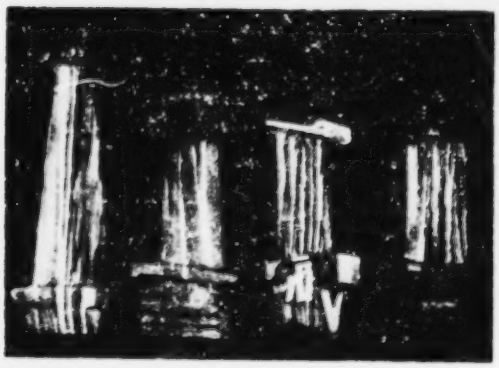


Figure 6. Several Types of Turbine Blades for Aviation Engines Produced in China

Figure 7. Shell Mold for the Ethyl Ester Silicate-Corundum Series Blades Awaits Pouring

Table 2.

Chemical Composition		Physical Properties	
Al_2O_3	~ 68 percent	Mullite	80 percent
SiO_2	~ 25 percent	Degree of fire resistance	>1,770°C
FE_2O_3	~ 1.3 percent	Porosity	~35 percent
TiO_2	~ 2.8 percent	Ash content	~0.5 percent
CaO MgO	~ 0.6 percent		
K_2O+Na_2O	~0.1 percent		

2. Mold Core

The porcelain mold core used for pouring directional hollow blades is the same as that of the shell mold. It has to bear many working conditions that are much harsher than those in ordinary fine casting. The mold core material must be strong in high temperatures, the thermal stability must be good, and removal of the core must be easy. For several years, our nation has conducted research in oxidized magnesium based and quartz glass-zirconium quartz powder based porcelain mold core materials and we have finally developed successfully a mold core material suitable for use in manufacturing directional hollow blades. At present, we already can manufacture directional hollow blades with a wall thickness of less than 1 millimeter, an aperture of 0.2 to 0.5 millimeter, relatively complex interior channels and interior cavities that have a smoothness reaching 74 to 76. Figure 8 shows the external shape of hollow turbine blades for engines and the porcelain mold core used.

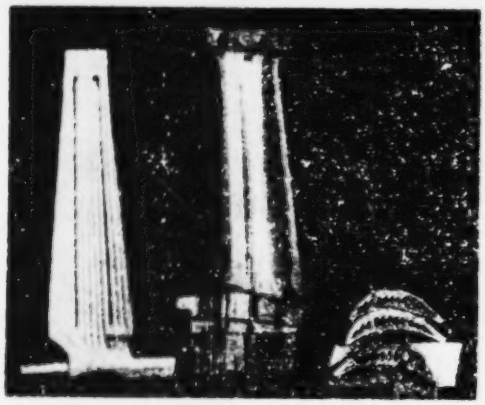


Figure 8. The Turbine Blades for a Certain Engine and the Porcelain Mold Core Used in China

III. Development of Directionally Solidified Alloys

The continued perfection of directional solidification technology has created conditions for the development of directionally solidified alloys. For more than 10 years, our nation has continued to develop successfully a number of directionally solidified high temperature alloys and these have preliminarily formed our nation's series of directional high temperature alloys, such as: DZ-3, DZ-5, DZ-9, DZ-17G, DZ-22, etc. (Please refer to the no 4 issue of this magazine for 1981, for their chemical compositions). These alloys all possess good comprehensive mechanical properties in high temperatures and medium temperatures and superior heat fatigue properties and satisfactory thin wall properties. The DZ-3 and DZ-22 alloys are the most outstanding.

Table 3. Comparison of Instantaneous Properties of the DZ-3 and DZ-22 Alloys and the ЖС6КНК, PWA-1422 Alloys

Alloy	Temp.°C	σ_b, kg/mm^2	$\sigma_{0,2}$, kg/mm^2	δpercent	ψpercent	Remarks
DZ-3	room temp.	98/100	--	5.0/7.0	4.0/7.0	
	760	119/120	--	9.6/11.4	15.8/20.4	
	900	91/93	--	8.0/9.2	11.2/11.2	
	980	69/70	--	21.0/29.4	31.2/31.8	
	1000	65	--	19	34	
ЖС6КНК	room temp.	90		3.6		
	900	98/109	81/85	--	--	
DZ-22	room temp.	116	--	8.0	9.0	
	760	121	--	8.0	15.0	
	980	65	--	13.0	28.0	
	1000	60	--	23.0	28.0	
PWA1422	room temp.	113	96	6.1	8.3	
	760	121	98	9.0	14.0	
	980	63	49	21.8	28.0	

Table 4. Comparison of Permanent Properties of the DZ-3 and DZ-22 Alloys and the ЖС6КНК, PWA 1422 Alloys

Alloy	Temp.°C	Stress, kg/mm^2	Useful life, hours	δpercent	Remarks
DZ-8	760	78	100		
	900	35	100		
	980	21	100		
	1040	14	100		
	1093	8.4	100		
ЖС6КНК	900	32/34	100		
	975	23	70	--	
		26	64	18	
DZ-22	760	73.8,78	210	14.8	
	870	45.7	122	25	
	980	22.5	84	20.4	
	1040	14	110	24.8	
	1093	8.44	75	30	
PWA1422	760	70.3	700	3.2	
	870	42	180	6.3	
	980	21.1	70	19.0	
	1040	12.66	130	20.0	

Our nation's research in directional alloys was carried out on the basis of currently available high temperature cast alloys. Appropriate directional techniques were developed for ordinary cast alloys to obtain better comprehensive mechanical properties in high temperatures and medium temperatures and superior heat fatigue properties and satisfactory thin wall properties. The DZ-3 and DZ-22 alloys are the most outstanding.

Our nation's research in directional alloys was carried out on the basis of currently available high temperature cast alloys. Appropriate directional techniques were developed for ordinary cast alloys to obtain better comprehensive mechanical properties. The emphasis in research work was mainly on understanding the effects of directional solidification technology upon the various properties of alloys, especially anticreep properties, thermal fatigue properties, thin wall properties, long period results and structural characteristics of directional alloys, etc. At the same time, we also studied parametric changes in adjustment and in the directional solidification technology for alloy elements (such as C, Hf) and the effect of the selection of the standards of heat treatment upon the structure and properties of alloys. After a lot of experimental research, we selected the suitable chemical compositions and technological parameters and obtained data on ideal comprehensive properties. We have already developed successfully several kinds of alloys which have properties that are superior to those of ordinary cast alloys of the same composition and we have reached the levels of similar types of foreign directional alloys as regards properties. Table 3 and 4 list the instantaneous properties and permanent properties of the DZ-3 and DZ-22 alloys and a comparison with those of the ЖС6КНК alloy of the Soviet Union and the PWA-1422 alloy of the United States. It can be seen from the data in the table that our nation's directional solidification technology has reached or is approaching the advanced levels of foreign nations.

In recent years, our nation has also developed research in monocrystalline alloys and directional cocrystalline alloys and has realized encouraging progress. This has established a good foundation for the further development of cast turbine blades for aviation engines.

Conclusion

The use of directional solidification technology to manufacture turbine blades for aviation engines can produce good results. This has been generally recognized domestically and abroad. For more than 10 years, our scientific and technical workers have done a lot of experimental research, have grasped and developed this advanced technology, have realized visible achievements and have contributed towards the development of our nation's aviation industry. At present, our nation not only has directional solidification equipment, technology and alloys of the world's advanced level, it also has a fairly large capability to produce directional blades. It can be believed that as our nation's aviation industry continues to develop, directional solidification technology will be more broadly applied in our nation.

9296
CSO: 4008/182

Engineering Thermophysics

AUTHOR: CHEN Yunxian [7115 6663 6897]
CEN Kefa [1478 0668 3127]
ZHANG Hesheng [1728 7729 5116]
ZHANG Xuehong [1728 1331 1347]
KANG Qifu [1660 7871 4395]

ORG: Zhejiang University

TITLE: "Experimental Studies of Fluidized Twin-Bed Boiler for Low Grade Solid Fuels"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 4, Nov 81 p 372

ABSTRACT: The construction principle of the industrial boilers with two fulidized beds operating in parallel is briefly introduced. According to the results of heat balance tests, it is evident that the thermal efficiency of the boiler when burning low grade solid fuels, may be increased from 53.9 to 70.7 percent as compared with the single fluidized bed boilers. Dynamic properties of combustion process in fluidized bed boilers when burning low grade solid fuels with broad size distribution and firing fly ash with narrow size distribution were experimentally determined, and the results of which were preliminarily investigated. Accordingly, problems in fluidized bed boiler design and operation have been examined, and reasons accounting for the increase of thermal efficiency are also given.

CSO: 4009/377

AUTHOR: None

ORG: The Editorial Department of the Journal

TITLE: "Brief News of the Conference of Engineering Thermodynamics and Energy Conservation and the Conference of Aero-thermodynamics of Heat Engines Held in Xiamen, Fujian Province "

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 4, Nov 81 pp 408-409

ABSTRACT: On.18-24 Aug 81, the conferences of the 2 specialties of engineering thermodynamics and energy conservation and of aero-thermodynamics of heat engines were held simultaneously in Gulangyu of Xiamen. They were called jointly by the Chinese Engineering Thermophysics Society and the Chinese Aviation Society. There were 154 official delegates and substitutes; of these a large portion of the 104 authors of the submitted papers were middle-aged scientists. A portion of these delegates were old scientists and newly graduated researchers. Dr. LIU Ruisen [0491 3843 2773] a central figure of the Research Institute of Engineering, Dynamics, and Information Science of France was invited to deliver the report on "A New Method of Resolving Ternary Flow." Professor WU Zhonghua [07020112 5478], the Editor-in-Chief of this journal called an expanded meeting of editors of both societies during the conference time to make preliminary selections from the papers submitted to be gradually published in the journal. It was suggested at the conference that the international unit measurement system will be adopted in the journal, starting with the next year's issue.

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END

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3 September 1982

China Report

SCIENCE AND TECHNOLOGY

No. 173

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SCIENCE AND TECHNOLOGY

No. 173

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CHINESE-MADE 'Y-7' FLIGHT TESTS SAID SUCCESSFUL

Turboprop Transport May Fill Many Roles

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 7, Jul 82 pp 2-3

[Article by Li Yuanwen (2621 0337 2429) and Chi Wenjun (6688 2429 3182)]

[Text] Designed to meet the needs of transportation along feeder routes in this country, the Chinese-made "Y-7" is a medium range twin-engine turboprop airplane with a passenger capacity of 48-52 people. If necessary, it can be modified into a cargo plane or a combination passenger-cargo airplane. It can also be used to perform such missions as resource exploration, mapping, aerial delivery, and rescue.

The "Y-7" has two WJ5A-1 turboprop engines, each with an equivalent power of 2,900 hp, which is sufficient for take-off under high altitude and high temperature conditions. It is well suited to operate under the wide range of terrain, geographic, and weather conditions of China's vast territory, and therefore can satisfy the needs of transportation along the feeder routes of this country. The "Y-7" has been flight tested in typical high-altitude airports such as Kunming, Lanzhou, Xining, Guelmo; and in airports with high summer temperatures such as Shanghai, Canton, Nanking, Wuhan, Chungking; as well as in airports with unpaved runways such as Hanzhong, Xianyang, and Shanyuan. The "Y-7" has accumulated over 1,600 flight hours and over 3,600 take-offs and landings. In early April, flight tests were conducted at the Tianjin Commercial Airport, which included: 19.2-ton and 21-ton single-engine take-off tests, and 21-ton single-engine take-off abort tests.

The maximum range of the airplane is 1,900 km; if the plane is carrying 48 passengers with a 45-minute fuel reserve and a take-off weight of 21 tons, the range would be 1,000 km.

Because of the large take-off power of the engine, the sea-level climb rate can be as high as 8.5 m/sec. When the take-off weight is 21 tons with both engines at rated power, the ceiling is 8,750 m. With a take-off weight of 21 tons and engines operating at 85 percent of their rated power, the cruising speed is 480 km/hr. According to specifications, if the airplane took off from an airport at sea level under 40° C temperature, or from an airport 2,000 m above sea level under 20° C temperature, and shut off one engine after

reaching a safe altitude, the maximum take-off weight is limited to 21.8 tons under the condition of 2.5 percent second-stage climb. With a take-off weight of 21 tons under standard atmospheric conditions, the take-off distance is 580 m, and the landing distance is 575 m. With a take-off weight of 20 tons, the ceiling for single engine operation is 3,400 m.

The important technical data of the "Y-7" are as follows:

length	23.708 m
width	2.9 m
wing span	29.25 m
height	8.56 m
main wheel base	7.9 m
front wheel base	7.9 m
wing area	75 m^2
maximum take-off weight	21,000-22,000 kg
maximum landing weight	21,000-22,000 kg
empty weight	14,235 kg
maximum fuel capacity	4,000 kg (without auxiliary fuel tank)
	4,800 kg (with auxiliary fuel tank)
maximum payload	4,700 kg

The fuselage of the "Y-7" has a semi-rigid structure; its cross-section consists of two circular arcs with different diameters. The fuselage has three sections; the front and midsections are sealed cabins. The front section contains the cockpit and a 4.5 m^3 forward luggage compartment. The cockpit can accommodate 5 crew members: pilot, co-pilot, navigator, radio operator, and engineer. The midsection contains the passenger cabin, the service cabin, and a 7 m^3 rear luggage compartment. The passenger cabin has a volume 10m x 2.76m x 1.86m. The basic model can accommodate 48 passengers and 1 service person, with 780 mm clearance between rows; the economy-class model can accommodate 52 passengers and 1 attendant, with 720 mm clearance between rows. The 0.75m x 1.4m passenger door is located at the left side of the fuselage; the 1m x 1.2m cargo door is located at the forward right side; and the 0.51m x 0.60m emergency door is located at the right side.

The wing is composed of a rectangular central section, and trapezoidal mid- and outer sections. The wing cross-section is a laminar-flow airfoil with double convex profile. The wing design has a geometric twist as well as aerodynamic twist to improve flight characteristics during loss of speed. The central wing section contains a soft fuel tank, which is joined below with the engine and the main landing gear. The midwing section is an integral fuel tank. The central wing section has a single-split flap, the mid wing section has a double-split flap, and the outer wing section has two segmented ailerons. The leading edge of the wing is equipped with a heating device for ice prevention.

The cantilevered tail structure is all metal; the horizontal tail has an upward tilt angle to minimize the adverse effects from wing turbulence, but it still remains in the smooth slipstream generated by the propeller. The large

fins above and below the fuselage provide improved lateral stability. The landing gear is of the forward three-point type, each with two wheels hydraulically operated. The front wheels are used for turning, and the main wheels are equipped with disc brakes. The landing gear is retractable in the forward direction to ensure emergency release under the action of head-winds and gravity. The main landing gear is equipped with low-pressure tires so that the airplane can take off and land safely on an unpaved runway.

The turbine blades of the WJ5A-1 turboprop engine are designed using advanced hollow air cooling technology, so that the engine power can be increased by raising the temperature of gas entering the turbine. The engine is also equipped with a speed conversion device which provides two speeds of rotation I and II. During take-off at speed II, the engine can generate power as high as 2,900 hp. The engines are located high above the ground to avoid debris from entering the inlets. The four-blade J16-G10A propeller has the capability to automatically vary the pitch and align the blades, and sufficient clearance is provided between the blades and the ground. In addition, there is a turbo-generator which can be used to start the engines in case no ground electric sources are available.

Two independent fuel systems can supply fuel to each of the two engines; the two systems are connected with a valve. The central wing section can accommodate four or eight soft fuel tanks, depending on customer requirement.

The hydraulic system consists of a main system and an emergency system. The main system is used to operate the flaps, [main] landing gear, front wheels, brakes, emergency propeller alignment, and emergency engine cut-off; the emergency system is used for emergency main wheel braking, and emergency operation of the flaps.

The elevator control surfaces are operated by steel cables; and the rudder and ailerons are operated by electric motors. The autopilot is connected to the control system, and can be activated by the pilot to operate the plane if the need arises.

The high altitude system performs the functions of automatic adjustment of air temperature and pressure to maintain proper cabin temperature and pressure, and to ensure an adequate supply of fresh air in the cabins. The air supply in the cabins is provided by the compressed air from the 10th stage of the compressor; it ensures that the cabin air is replaced 20-26 times every hour. The cabins are also equipped with two portable oxygen tanks for emergency use by the crew members and passengers.

The ice prevention system uses both hot air and electric heating. The wing and tail, the air inlet section of the engine, and the deflectors in the air intake are heated by hot air from the compressor; the propellers and the windshield are heated by electricity to prevent ice formation.

The electrical system includes a 27-volt d.c. supply, a 115-volt, 400-Hertz single-phase a.c. supply, and a 36-volt, 400-Hertz three-phase a.c. supply.

The main d.c. supply consists of two starting generators and two batteries as an emergency power source; the main a.c. supply consists of two generators, a single-phase alternator, and 4 three-phase alternators.

The navigation instruments include: gyroscopic half compass, gyro induction compass, magnetic compass, horizon sensor, autopilot, altimeter, speedometer, climb and descent rate meter, turn indicator, pitch indicator and clock; the radio navigation equipment include: radar, radio compass, radio altimeter, and receiver; the communication equipment include: short-wave and ultra short-wave transceivers, and intercom.

In order to reduce weight and to improve fatigue characteristics, extensive integral structures are used. For example, the main spar, plates, and ribs of the wing, joints between the engine and the wing, as well as joints between the fuselage and wing are all integral structures. The fuselage skin is attached to the long purlin using adhesive welding techniques.

During the development process of the "Y-7," various tests were conducted on the whole airplane as well as on individual components. They include: force and pressure measurements in the wind tunnel, static load test, ground resonance test, impact test of the landing gear, system test, design certification flight test, system and onboard equipment reliability test, etc. Fatigue tests of the whole airplane are currently underway; at present, fatigue test of the fuselage has exceeded 48,000 flight hours; the plan is to continue the test for a total of 120,000 hours.

On the basis of the ground and flight test results, it has been specified that major overalls for the "Y-7" will be every 5 years or 5,000 flight hours.

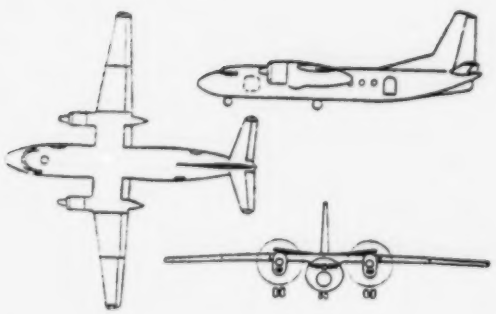


Figure 1. Three Views of "Y-7"

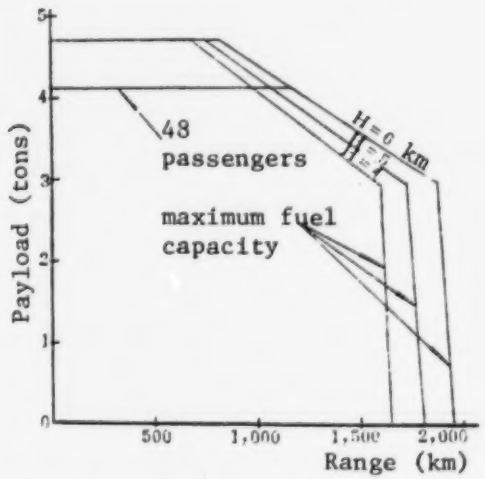


Figure 2. Payload-Range Diagram of "Y-7"

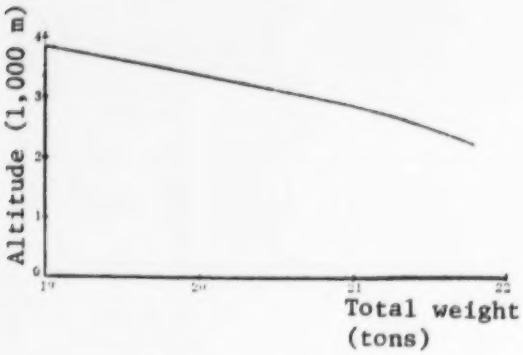


Figure 3. Single-Engine Ceiling of "Y-7"

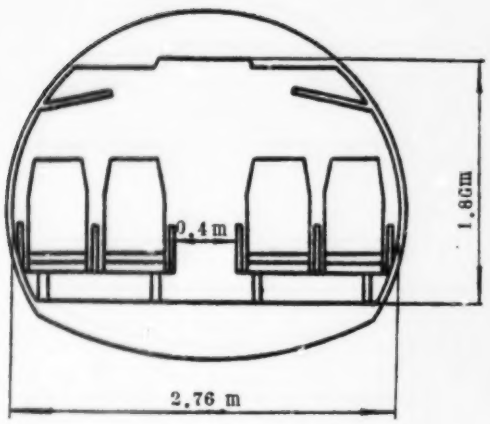


Figure 4. Seating Arrangement in Basic Model of "Y-7"

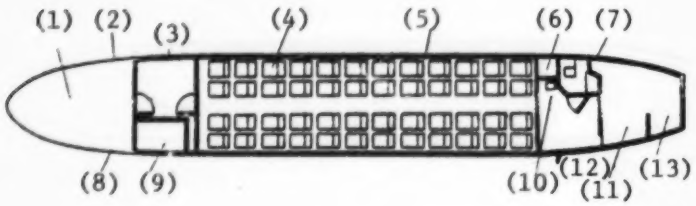


Figure 5. Internal Layout of "Y-7"

Key:

1. Front cockpit (left and right pilot seat)
2. Radio operator window
3. Cargo door
4. Passenger seats
5. Emergency exit
6. Food storage room
7. Luggage compartment door
8. Navigator window
9. Luggage compartment
10. Seat for service person
11. Coat and hat compartment
12. Passenger cabin door
13. Rear luggage compartment

Single-Engine Take-Off Tests Passed

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 7, Jul 82 pp 4 and 44

[Text] On the morning of 4 April 1982, we arrived at the Tianjin Zhang-guizhuang Commercial Airport. The Chinese made "Y-7" transport airplane was undergoing single-engine take-off tests at this airport.

The "Y-7" was designed to provide air transportation along side routes in this country. It can operate over China's vast territory under a wide range of weather conditions; and it can take off and land at most airports. The airplane can carry 48-52 passengers, or it can be modified into a cargo plane or combination passenger-cargo plane. Since its completion, the "Y-7" has visited airports located in 28 provinces, cities, and autonomous regions, except Xizhang region and Taiwan Province.

If one of the two engines fails during take-off, the pilot must be able to control the airplane and either continue taking off with a single engine or abort the take-off to ensure passenger safety. Consequently, the single-engine take-off test is one of the key tests for the "Y-7."

On the airfield, the ground crews are busy inspecting each system of the airplane over and over again. The spectators began entering the airfield in small groups, and gathered around a designated area. On this eve before "Y-7" goes into service, they could not contain their excitement. Some comrades were so confident in our scientists, engineers, and technicians that they had little doubt about the success of this test; others seemed a bit worried because they were concerned about the technical complexity of the test and our lack of experience.

At 5:25, members of the flight test team in civil aviation uniforms and the technicians began boarding the plane. With complete confidence in the performance of the "Y-7" and the success of this flight test, they smiled and waved at crew members on the ground. The two engines were started one after another, and the "Y-7" began rolling toward the runway.

At about 6:00, the commander issued a take-off signal. The "Y-7" with a take-off weight of 19.2 tons began accelerating on the runway. At this time, everyone on the airfield is holding his breath, but not the members of the flight test team. They were not only an experienced flight team but also had the common goal to develop China's aviation industry. Recently, they underwent intensive simulated flight training at various airports around the country; they acquired a thorough understanding of the airplane's performance as well as highly proficient operating skills. But this particular flight test is considered one of the most dangerous and most complex flight tests, and its success or failure would be determined in a split second. Thus, it is only reasonable that everyone is feeling the anxiety before the crucial event takes place.

Suddenly, the airplane has reached the critical speed. With the airplane 2.5 m above the ground, the right engine (key engine) was shut off, and the propellers began to slow down, and finally stopped. The left engine however continued to roar. After a slight disturbance, the airplane continued along its flight course, and climbed steadily upward; the landing gear was quickly retracted. Having reached an altitude of approximately 400 m and completed its take-off flight maneuvers above the airfield, the "Y-7" headed toward the runway and with a single engine gradually touched down. The pilot executed the maneuvers precisely and cleanly. The data measured from this test were better than expected; this single-engine take-off test was a complete

success! All the spectators rushed toward the airfield and expressed their congratulations to the members of the flight team and the technical team as well as the ground crew.

After a short rest, at 7:30, the same flight test was repeated with the take-off weight increased to 21 tons. For a medium size airplane, an increase of 1,800 kg in payload is a severe test for both the airplane as well as the flight team and technicians. But armed with their 19.2-ton experience and careful attitude, the second flight test was also successfully completed. As they happily stepped out of the airplane, the joy of success touched everyone on the airfield.

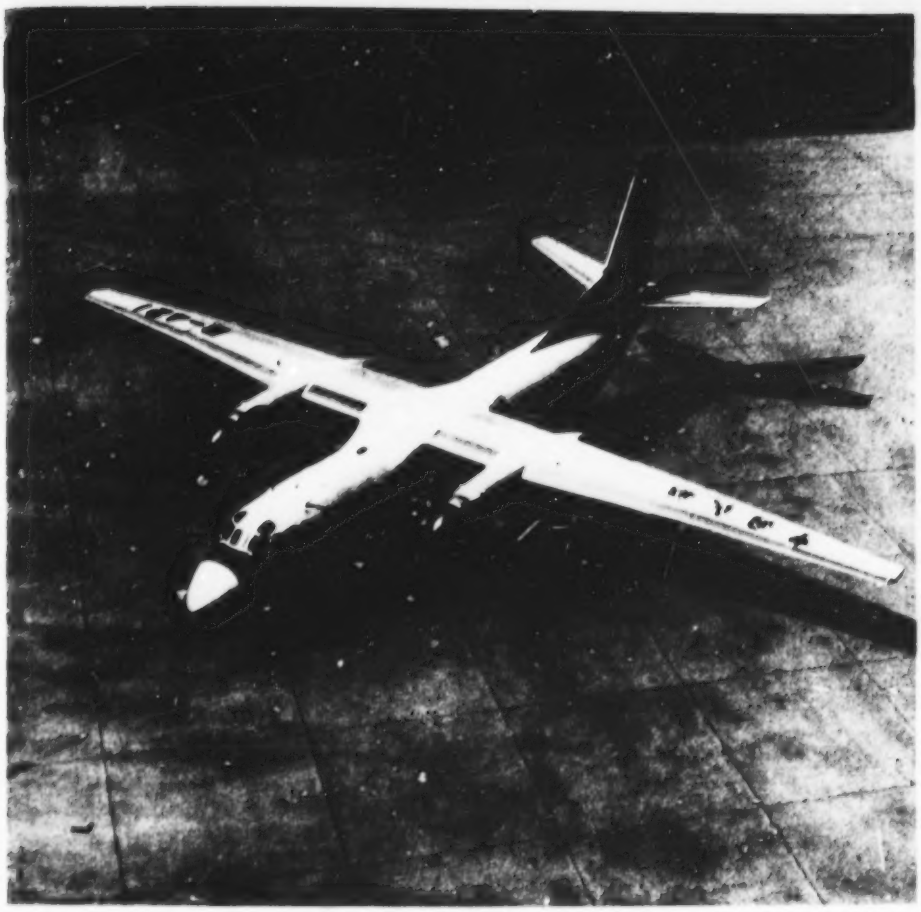
On 7 April, the "Y-7" underwent another flight test where take-off was aborted with a single engine. Compared with the previous test this event is much easier. But the flight crew maintained their serious attitude as usual, and the technicians were faithfully checking all the data. They firmly believe that the only way to ensure success is to maintain a serious scientific attitude. Under maximum take-off weight, the airplane successfully completed a sequence of operations: accelerating on the runway, lifting the front wheels, shutting off the right engine, automatically aligning the propellers, and applying normal braking before touch down. The result of the test was outstanding: the lateral displacement was only 4 m.

At this point, the flight test events of the "Y-7" were concluded.

With one engine shut off, the symmetry of forces acting on the airplane is destroyed. The airplane will suddenly tilt toward one side due to the thrust and moment of the operating engine, and the drag and moment of the idling engine. Furthermore, the lift coefficient will decrease and the drag coefficient will increase, resulting in smaller lift to drag ratio. This makes the control of the airplane more complicated and also places higher demands on the reliability, structural strength, and performance of the flight system. Therefore, the single-engine flight test was a severe test for all parts of the airplane.

The success of this flight test provided valuable reference data for future airplane design and certification; it also revealed a bright future for developing China's independent aviation industry.

In an interview with the members of the flight team, they all said, "We are really attached to this domestically produced passenger plane." The success of this test was a result of the joint efforts of technical personnel, laborers, and Party officers; it also depended on the unconditional support from all the departments concerned. Having passed this flight test, it will not be long before the "Y-7" is put into regular service.



"Y-7" during single-engine take-off tests.

3012
CSO: 4008/209

APPLICATION OF REMOTE SENSING TECHNOLOGY APPLIED TO FORESTRY

Guangzhou GUANGZHOU RIBAO in Chinese, 12 Jun 82 p 2

[Article by Zhang Tingchun [1728 1694 2504]]

[Text] On 26 May, Shen Pengfei, a famous 90-year-old forestry expert, and Professor Xu Yanqian climbed Nankun Mountain to set up a new experiment and research project at the South China Forest remote sensing experiment station located on Nankun Mountain.

The application of advanced remote sensing technology to modernized forestry is expected to accomplish what had not been possible until now in the field of tapping forest resources, monitoring changes and disasters, and resource management. Professor Shen Pengfei and the teachers of the South China Forestry Management Research Laboratory who selected the Nankun Mountain in 1980 as the site for the first south China forestry remote sensing experiment station had been working with the Ministry of Forestry and forest workers of the province on various experiments and research projects. With the aid of aerial photography and multispectral photography and surveying, they have prepared a set of representative photos of the forests of south China, and launched nine research projects covering the vegetation, forest communities and their development, the forest soil, and the natural renewal of the rare broad leaf species of Nankun Mountain. They also applied the remote sensing technology to cover the classification and successions of forests in south China, and studied the major forest types and the spectral characteristics of the principal species of trees on Nankun Mountain. The whole experiment station took nearly 2 years to complete. Now Professor Shen Pengfei and his associates have gone up the mountain again to prepare for new research projects, including multispectral and large-scale remote sensing flights scheduled to take place in the coming fall. The Ministry of Forestry will also dispatch its technical crew to conduct extensive surveys.

5360
CSO: 5000/4054

BRIEFS

LIBRARY ARCHITECTURE SOCIETY--The National Library Architecture and Design Society held a meeting in Xi'an on 18 March 1982. The library director at our institute, Liu Dehuan, presented a paper "Discussions on problems of designing a library for institutions of higher learning." The architectural plans of the new library of our institute were displayed at the meeting. [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

ROTATING FURNACE SOCIETY--The National Rotating Furnace Society for Steel Production held a meeting in Liuchow 6-13 March 1982. From the Steel Smelting Department of our institute, Assistant Professors Xu WenPai [1776 2429 3175], Feng Chunrong [7458 2504 2807] and instructor Jiang ShiCai [6199 1597 5591] attended the conference and presented two papers: "Studies on the penetration lengths of side-blown oxygen streams into the melting troughs of steel furnaces" and "Directions and procedures for energy saving in rotating furnaces for steel production." They also exchanged three papers. These papers have been put into the collected papers of the Chinese Metallurgical Society. [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

GEAR TECHNOLOGY IN METALLURGICAL MINES--From 27 March to 1 April 1982, a meeting was held in Suzhou on gear technology in metallurgical mines. From the Mechanical Engineering Department of our institute, Assistant Professors Hu Maoxian and Cai Chunyuan and instructor Gao Shiyuan attended the conference and presented two reports: "Studies on steel gears" and "Studies on improving the life and load capacity of axial gears in steel-forging machinery." [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

METALLURGICAL MECHANICS, STEEL SMELTING--A conference on metallurgical mechanics and steel-smelting theories was held at Chongqing University 12-16 April 1982. From the Steel Metallurgy Department of our institute, Professor Ren Shizheng and Assistant Professor Xiao Zeqiang, and from the Colorimetry Department, Professor Liang Ningyuan and Assistant Professor Shen Shiying attended the conference and presented three papers: "Momentum Transport in Metallurgical Processes," "Current status of research on the fundamental theories of jet metallurgy," and "Transport theories of the lead loss in the electrolysis of molten $PbCl_2$." The conference also decided to

establish a section on "transport theory in metallurgy." The second conference on this subject is scheduled to be held at our institute in 1984. [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

MICROCOMPUTER TECHNOLOGY IN METALLURGICAL SYSTEMS--A conference on microcomputer technology in metallurgical systems was held in Kunming 16-20 April 1982. The faculties of our institute presented six papers and exchanged five papers. Two papers are included in the conference proceedings: "Microcomputers for the processing of spectroscopic data" by instructor Yan Boqian of the Servo-Systems Department, and "Control systems for general documents" by Du Haiquan. [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

ELECTROMECHANICAL ENGINEERING CONFERENCE--The first national electromechanical engineering conference on variable analysis and optimal design met in Hongchow 17-20 April 1982. Four papers were presented by our faculties: "Optimal design for the casting of crane cylinders" by Assistant Professor Zhou Peide, "Variable analysis by repetition" by Assistant Professor Li Yujuan, "Solutions of Difference Equations by Iteration" by Assistant Professor Wang Junshu, "Variable Mixing Methods for Elastic Contact Problems" by assistant Professor Hu Gar-Low. [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

FLUID MECHANICS, HYDRODYNAMICS CONFERENCE--The first national conference on multiphase fluid mechanics, non-Newtonian fluid mechanics and physical chemistry of hydrodynamics met in Beijing 17-21 April 1982. Two papers were presented by the Mechanical Engineering faculty members of our institute: "Studies on the motions of particle groups in centrifugal ore separation machines" by Assistant Professor Tong Qingli and "Theoretical analysis of particle velocity variations in flotation processes" by instructor Di Qingliang. These papers were included in the conference proceedings. The conference decided to establish a new section on multiphase fluid mechanics. Assistant Professor Tong Qingli has been elected as the director of the section. [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

MINE VENTILATION SYSTEMS--A conference on ventilation systems for mines and their operating experience was held at the Hu-Keng tungsten mine in Jiangxi Province 6-12 May 1982. From the Ore Exploration Department of our institute assistant Professors Wang Yingmin and Chen Rongce attended the conference and presented two summary reports: "Outline of the development of ventilation technology in metallurgical mines during the past 32 years" and "Aerodynamics in mines and ventilation systems." They also presented a research paper: "Studies on filtering technologies in mines." [Text] [Shenyang DONGBEI GONGXUEYUAN XUEBAO [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 p 118] 9899

CSO: 4008/200

TAIWAN: MICROCOMPUTER CAPABLE OF PROCESSING CHINESE

OW031325 Taipei CNA in English 0944 GMT 3 Aug 82

[Text] Taipei, 3 Aug (CNA)--The first microcomputer which has the capability to process Chinese (?data), Microprofessor II Chinese (MPF-II-C), is scheduled to make its debut this August as another innovative microcomputer made by Multitech Industrial Corp. Though it is the first Chinese home computer, it is priced for less than U.S. $600.

The MPF-II-C is innovative because with a compact size (9.84 x 7.65 x 1.23 inches), using the Chinese character controller (CCC) which contains only 64k bytes of memory, the MPF-II-C can access 22,000 Chinese characters.

Considering the fact that only 4,800 Chinese characters are commonly used, it is generally acknowledged that the MPF-II-C can process almost all Chinese characters. What is special about the MPF-II-C is that it is multilingual, because it can also process Roman characters.

Without the CC, this microcomputer is exactly the same as Microprofessor II (MPF-II), a microcomputer (?compatible) to the Apple II personal computer in basic interpreter.

Incorporated into the CCC are the "dragon Chinese alphabet coding system (dragon coding)" and the "dragon Chinese character generating system (dragon generating)," which are also used on the dragon Chinese terminal D75, which is another Multitech product with innovative design. Using the dragon coding system, every Chinese character can be decoded into 1 to 5 codes with each Chinese character averaging 3.8 codes.

CSO: 4010/13

AUTHOR: ZHOU Wenzhong [0719 2429 1813]
HU Zhicai [5170 1807 2088]

ORG: Both of the Beijing Institute of Control Engineering

TITLE: "An Attitude Determination Method of Spin-stabilized Geostationary Satellite"

SOURCE: Beijing ZIDONGHUA XUEBAO [ACTA AUTOMATICA SINICA] in Chinese No 3, 1982 pp 175-187

TEXT OF ENGLISH ABSTRACT: In this paper a method is presented in which the rotation angle from sun-earth midscan λ_{se}, in addition to the earth angle θ_e and sun angle θ_s, is simultaneously used for determining spin-stabilized geostationary satellite attitude.

This method uniquely gives one unambiguous attitude solution, simplifies the algorithm, eliminates regions of high correlation and low measurement density occurring when using two attitude measurements and provides geometric conditions where singularity occurs only if the earth and sun vectors are colinear. By this method the angle λ_{se} in conveniently incorporated into the kalman or least square filter.

Digital simulation showed that better accuracy of attitude determination and filter estimation can be obtained by this method.

9717
CSO: 4009/375

AUTHOR: None

ORG: Reporter of the Journal

TITLE: "Symposium on BOF Process"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 6, Jun 82 pp 78-inside back cover

ABSTRACT: The National Symposium on BOF Process, jointly sponsored by the Chinese Metals Society and the Iron and Steel Company of the Ministry of Metallurgical Industry was held on 6-12 Mar 82 in Liuzhou Iron and Steel Mill. Participants included 168 delegates representing 91 iron and steel enterprises, local medium and small iron and steel mills, scientific research and dasigning institutes, schools of higher education, intermediate specialty schools, and management departments. The results of research on oxygen top-blown convertor process and its production experiences in China were summarized and exchanged. Ways of carrying out further refinement, improving techniques and equipment, promoting scientific work procedures, and raising the economic benefits were discussed. The symposium was divided into 3 parts: The first part was devoted to scientific exchanges; 36 production and research reports were read and 50 additional papers were received. The second part was devoted to discussion and revising the basic work procedure of the oxygen top-blown convertor process, with the major goal of improving the quality, reducing waste, and adding more types of products. The third part was devoted to introducing the current production condition, major problems, and future direction of research.

AUTHOR: None

ORG: Metallurgical Slag Comprehensive Utilization Specialty Group

TITLE: "Technical Exchanging Meeting on the Use of Electric Furnace Slag"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 6, Jun 82 inside back cover

ABSTRACT: The National Electric Furnace Slag Utilization Technology Exchange Meeting, jointly sponsored by the Metallurgical Slag Comprehensive Utilization Specialty Group of the Metallurgy Environment Protection Committee of the Chinese Metals Society, Chinese Environmental Science Society, and the Solid Waste Pollution Control and Comprehensive Utilization Group of the Environmental Engineering Society was held 23-27 Dec 81 at Laiwu Steel Mill and Yangzhou Construction Plant. Participants included 90 delegates representing 57 organizations of metallurgy, machinery, railway, construction materials, geology, national defense, and universities, colleges, and specialty schools. The major contents of discussions at the meeting include the following: (1) The condition of research, production, and application of white cement made from electric furnace reduction slag was introduced. (2) At present, the water quenching process is used for steel slag granulation treatment; delegates agreed that the technique should be gradually extended. (3) The capacity of China's electric furnaces is small, its distribution extensive, and the production conditions of all the mills are very different; therefore, different ways must be adopted to utilize the slag as construction material, road paving material, etc. to resolve the problem of pollution and reduce the production cost.

6168

CSO: 4009/379

AUTHOR: PU Qing [3184 3237]

ORG: None

TITLE: "Second Annual Conference of Shanghai Municipal Bonding and Joining Technology Association Held"

SOURCE: Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 7, 20 Jul 82 pp 17, 42

ABSTRACT: The Shanghai Municipal Bonding and Joining Technology Association held its second annual conference on 24-26 May 82. A total of 370 persons attended, representing departments of chemical engineering, bonding and joining associations of other cities, related organizations, and bureaus of various industries of Shanghai. The conference first reviewed the condition of research, manufacture, and utilization of adhesives. It was pointed out that an adhesive is a refined chemical product and its application has become a new boundary science, which will have an important function in the national economy. The conference received and exchanged 45 papers which contributed new techniques and work procedures to the application of bonding and joining technology. Experiences in sealing machine tools, stabilizing structural members of machines, substitutes of riveting or soldering, and repairing worn and broken parts were exchanged and discussed.

AUTHOR: None

ORG: None

TITLE: "The M 50100 Single Arm Slideway Grinder, Produced by Shanghai Heavy Machine Tool Plant"

SOURCE: Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 7, 20 Jul 82 front cover, p 40

ABSTRACT: A photo of the M 50100 single arm slideway grinder is used as the front cover of this issue of the journal. The grinder is equipped with 3 grinding heads, has hydraulic drive, thin film feedback, and static pressure lubrication. Its property is reliable and precision stable. The major technical parameters of the grinder are described and explained on p 40. The adresses of the manufacturer, its business office, and telephone numbers are given, as well as other products made by the manufacturer.

6248
CSO: 4009/378

AUTHOR: HE Jiankun [0149 1696 0981]
WU Zongxin [0702 1350 9515]
LU Yingzhong [0712 2019 0022]

ORG: All of the Institute of Nuclear Energy Technique, Qinghua University

TITLE: "The Optimal Programming for a Nuclear Power System"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 97-106

TEXT OF ENGLISH ABSTRACT: A nuclear power system is very vast and complex. The entire national nuclear power system may consist of several types of reactors. These types of reactors make up a symbiotic fuel cycle system. The technology of thermal converters has matured and its power generation cost is cheaper. However, its uranium utilization is lower. Although the gain of nuclear fuel for FBR is very fast, a larger inventory of fissible fuel and more capital are needed, and the inventory during the initial stage of FBR development must be supplied by the thermal converters. Therefore, there exists an optimal mix of thermal converters and FBR, which can achieve better economic effects in this system. In addition, the economic scale of nuclear industry enterprises is very large now. It is necessary to consider the appropriate introduction schedule of these enterprises.

[Continuation of HEKEXUE YU GONGCHENG Vol 2 No 2, Jun 82 pp 97-106]

This paper describes the dynamic linear programming model developed for a nuclear power system. Based on the physical essence of each process in this system and nuclear fuel flows, the various equilibrium equations and restraint relationships of variables are set up. These mathematics models describe the whole physical process of the nuclear fuel cycle. Both linear programming and mixed integer programming are used to solve these problems. The primary results have well represented the dynamic characteristics of the whole system and given out the activity level of each process, the flow rate of nuclear fuel between processes and the number of economic scale enterprises in each time period under optimization conditions. The dynamic linear programming model is an efficient approach for the nuclear power system project.

AUTHOR: None

ORG: HWRR Laboratory, Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Reconstruction of HWRR and Its Primary Cooling Circuit"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 107-116

TEXT OF ENGLISH ABSTRACT: This paper describes the implementation of reconstruction work of HWRR, the first research reactor operated in China.

After 20 years of operation, the core tank was replaced by a new one with some modification of the core arrangement. The primary cooling system was also modified and overhauled in order to upgrade the cooling capacity and reactor power level. The old core tank was integrally buried in a pit under the reactor hall. Measures were taken to decrease radiation hazard. The collective radiation dose of the whole project, which stretched for a period of 22 months, is 168 man-rem. High quality was assured. All design targets were achieved, and the HWRR was successfully put into on-power operation in October 1980.

AUTHOR: HONG Jingfeng [3163 2529 6265]
ZHAO Shoujun [5392 1343 6874]
JIANG Zilong [5592 5261 7893]
et al.

ORG: All of the Southwest Institute of Nuclear Reactor Engineering

TITLE: "The Analysis and Experimental Study of Impact of the Tube Against Supporting Baffles in Heat Exchanger"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 117-128

TEXT OF ENGLISH ABSTRACT: In nuclear reactor engineering, the vibration of the fuel element rod and tube of the heat exchanger is frequently induced by coolant flow. They always strike the intermediate supporting baffles during vibration. This kind of impact is intermittent and repeated. As a result, the wear and fretting of the tube will be created, causing damage. Therefore, it is very important to study the dynamic effect of this impact. In recent years an investigation of this problem has been conducted by the authors.

The dynamic effects of impact of a tube with fixed ends against multi-intermediate supports have been studied experimentally and analytically in this paper. The tested model is a stainless steel tube of 13.20 mm O.D., 10.20 mm I.D. and 1436 mm in length. Its ends are clamped. The baffles are simulated with support plates.

[Continuation of HEKEXUE YU GONGCHENG Vol 2 No 2, Jun 82 pp 117-128]

Their number is up to three and their positions are adjustable. The rigidities of the support plates are different. The clearances between the tube and plates are in the range from 0.20 mm to 1.00 mm. The duration and number of times of impact and time-history of response of the tube motion are recorded.

The test results show that the tube dominantly vibrates in the form of a beam with a single span, but the fundamental frequency is higher than its first natural frequency. The curve of the ratio of fundamental frequency of response to first natural frequency of beam vs the ratio of initial displacement to clearance is given. Also the curve of the duration for contact with support vs initial displacement-clearance ratio is obtained. The calculation is made by the theory of beam vibration. The analytical and experimental results are in good agreement. Many components of higher frequency are introduced into the response of motion. Their frequencies depend upon the position of support and their magnitudes are relative to intensity of impact. The linear spectrum of frequency for the motion response is given by Fourier Analysis.

AUTHOR: SUO Changan [4792 7022 1344]

ORG: Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Interconversions of Critical Size in Reactors with Irregular Arrangement of Control Rods (II)"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 129-139

TEXT OF ENGLISH ABSTRACT: By using the principle of "imaginary reactor," the conversion of critical size which relates many control rods within the rectangular reactor to one single control rod has been derived. In addition, the interconversion which related the rectangular to the cylindrical reactor has also been done. The theoretical results agree well with the experimental ones.

AUTHOR: FU Longzhou [0265 7893 5297]

ORG: Xi'an Jiaotong University

TITLE: "Optimal Linear System with Prescribed Degree of Damping or of Stability"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 140-147

TEXT OF ENGLISH ABSTRACT: This paper studies the optimization of linear systems, including the linear nuclear reactor system, with the "modified frequency method."

In general, when the quadratic performance index is used, the optimization of the system requires that the value of the performance index J be a minimum. In practice, the minimal value of J does not mean that the index of the quality of the transient response is satisfactory.

In this paper when the problem of optimization of linear systems is studied by the modified frequency response method, not only can the minimal value of the quadratic performance index be obtained, but also the transient response can be obtained simultaneously with the prescribed degree of stability or degree of damping. This method, when used in conjunction with the Kalman equation, appears extremely convenient and useful.

AUTHOR: YANG Yaochen [2799 5069 5256]

ORG: Institute of Plasma Physics, Chinese Academy of Sciences, Hefei

TITLE: "Effect of the First Wall Thickness and Its Impurity to the Yield for Uranium-Plutonium Cycle Fusion-Fission Hybrid"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 148-157, inside back cover

TEXT OF ENGLISH ABSTRACT: The characteristic parameters expressing the hybrid performance are defined. The basic configuration and results of neutronic calculation for the hybrid are presented. The effects of various first wall thickness to the yield of the hybrid are calculated, and the effects of the impurity contained in the first wall material to the yield of the hybrid are analyzed. It is shown that the effect of the first wall thickness to the yield of the hybrid is serious, but the purity of the first wall of the hybrid is unimportant. As for the important structural material, the first wall, the research focal point should lie in obtaining high strength and high antiradiation capacity for decreasing the first wall thickness; in addition, the purity of the alloy is not overcritical.

AUTHOR: PEI Lucheng [5952 7773 2052]

ORG: Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Study of Random Sampling Methods for Scattering Directions"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 158-164

TEXT OF ENGLISH ABSTRACT: The random sampling of the scattering direction is not only quite common but also very important in Monte Carlo calculations of particle transport problems. In this paper, several new random sampling methods that avoid the calculation of trigonometric and all other complicated functions are developed. The distributions considered here include those of general scattering angle, isotropic scattering angle in the laboratory system, isotropic scattering angle in the center-of-mass system, and uniformly distributed scattering azimuthal angle. The efficiency of these new random sampling methods is high in comparison with the best of the existing methods.

AUTHOR: MENG Xiangti [1322 4382 2251]
DU Guangting [2629 0342 1656]
LIU Kaimin [0491 7030 2404]

ORG: All of the Institute of Nuclear Energy Technique, Qinghua University

TITLE: "Electrical Properties and Radiation Defect Annealing Behavior of NTD Silicon Grown by Floating Zone Method in Hydrogen Atmosphere"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 172-181

TEXT OF ENGLISH ABSTRACT: Electrical properties and radiation defect annealing behavior of NTD Si grown by the floating zone method in hydrogen atmosphere were studied by Hall coefficient-resistivity measurements, minority carrier lifetime measurements and deep level transient spectroscopy (DLTS). The neutron doping was performed at temperatures of ~30°C and ~200°C separately in our swimming pool-type research reactor, with the Cd-ratio of ~10. The concentration of transmuted ^{31}P is ~6 x 10^{13} atoms cm^{-3}. One hour isochronal annealing from 400°C to 1200°C was carried out in a quartz-tube furnace with high pure nitrogen atmosphere. In this paper the isochronal annealing results of free carrier concentration, mobility and DLTS measurements were given and the energy level, capture section and concentration of the remaining deep level defects were calculated. Preliminary experimental results indicate that because of the existence of hydrogen, this NTD Si exhibits

[Continuation of HEKEXUE YU GONGCHENG Vol 2 No 2, Jun 82 pp 172-181]

some obvious characteristics. For example, the temperature of P→N type transformation and recovery temperature of carrier concentration and mobility is lower than those of the samples grown in an argon atmosphere. After annealing at ~450°C, an excess donor concentration and a high concentration of DLTS defects have been observed. At higher doping temperature the concentrations of the above-mentioned donor and DLTS defects are higher, and the mobility and minority carrier lifetime are lower than those at lower temperatures. The isochronal annealing curves of free carrier concentration and mobility have a greater waving when the annealing temperature is lower than 850°C. The results also indicate that annealing behavior of deep level defects is in good agreement with the changes of lifetime and carrier mobility. It is pointed out that after annealing for one hour at 800~850°C, the radiation defects in this NTD Si can be removed and electrical properties can be recovered. The experimental results are discussed briefly.

AUTHOR: SUN Xueyu [1327 7185 3842]
HU Ransheng [5170 3544 3932]
LI Zhenyuan [2621 2182 0337]

ORG: All of the Beijing Comprehensive Instrument Factory

TITLE: "Palladium-Silicon Surface Barrier Nuclear Radiation Detectors with Wide Sensitive Region"

SOURCE: Beijing HEKEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 2, Jun 82 pp 182-188

TEXT OF ENGLISH ABSTRACT: The palladium-silicon surface barrier detectors made from N-type high resistivity silicon in which the width of sensitive region reaches 0.5-3 mm are presented. They possess features such as thin window, wide sensitive region, high bais voltage, low leakage current, high energy resolution, good stability, etc. The energy resolutions are 0.45 percent (20 mm^2 sensitive area, 1.5 mm thickness, ^{241}Am source, at room temperature, in vacuum), 1.7 percent (976 keV internal conversion electron of ^{207}Bi), and 0.98 percent (300 mm^2 area, 2 mm thickness, 976 keV internal conversion electron of ^{207}Bi, at -40°C).

9717
CSO: 4009/373

AUTHOR: ZHU Shiyao [2612 6108 1031]

ORG: Department of Physics, Shanxi University, Taiyuan

TITLE: "The Quantum Theory of the Two-mode Laser in a Three-level Atomic System with Common Low Level"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 289-300

TEXT OF ENGLISH ABSTRACT: The quantum theory of two-level atom single-mode laser system of Sargent, Scully and Lamb is extended to a two-mode laser in a three-level atomic system with common lower level, and a master equation is obtained for the system with all three levels being pumped. Four terms appear in the master equation that are absent in the single-mode case and those interpreted as two-photon processes play a special role in the present case. The master equation is represented by a probability flow diagram in two dimensions with the photon numbers n_1 and n_2 of the two-mode laser as variables. The probability flow diagram can be extended to infinity, and each arrow represents a term of the right hand side of the master equation. By taking the sum over one of the variables n_1 or n_2, the master equation is reduced to two equations, each of them being represented by a one-dimensional probability flow diagram. The equation of motion under steady state is obtained by considering the correspondence between the macroscopic balance and the microscopic balance.

[Continuation of GUANGXUE XUEBAO No 4, 1982 pp 289-300]

A parameter H is introduced to reduce the equation of motion and to facilitate the mathematical procedure and a formal solution is thus obtained. Using the equation of motion and its formal solution various operation characteristics are discussed. Among them are: the threshold condition for each mode; the condition of only one mode operation; the variation of photon statistics between single-mode operation and two-mode operation and the variation of photon statistics with the lower level both being pumped and not pumped.

AUTHOR: WANG Qi [3769 3823]

ORG: Shenyang Institute of Computing Technology, Chinese Academy of Sciences

TITLE: "A More Accurate Algorithm of the OTF"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 301-307

TEXT OF ENGLISH ABSTRACT: Starting from the Kirchhoff diffraction integral formulation, the complex amplitude distribution in the image of a point object is given with an approximation of excelling the Fresnel diffraction field. The new formula is derived by means of the wavefront surface generating the diffraction to the image plane and not introducing the reference sphere. The changing part δ of the distance r is expanded, as is $(1+\cos\alpha)/r$. The slant of the wavefront surface toward the image plane is also investigated. The wave aberration W is defined by a new form, convenient for computation of the formula. In order for the amplitude distribution to become an obvious model, the new variables $\tilde{y}$ and $\tilde{z}$ are quoted. There is the relation between them and the exit pupil coordinates y and z. Therefore, the amplitude distribution in the image of a point object is obtained by adding the three Fourier transforms, and then the OTF is given. The new algorithm is generalized for previous articles. In the numerical method, it is mainly explained by computing the wave aberration function $W(\tilde{y}, \tilde{z})$ and the functions $\tilde{\Psi}_0$,

[Continuation of GUANGXUE XUEBAO No 4, 1982 pp 301-307]

$\tilde{\Psi}_1$ and $\tilde{\Psi}_2$ through linear interpolation in the range of the two dimensions. Finally, this paper shows that deriving the new algorithm needs only the condition that is weaker than the Fresnel condition and also weaker than the far field condition.

AUTHOR: WANG Runwen [3769 3387 2429]

ORG: Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Three-dimension Stress Analysis"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 308-314

TEXT OF ENGLISH ABSTRACT: Three-dimensional stress analysis is usually using the method of frozen stress and the method of light scattering. Aben proposed varying the polarization state or the wavelength of incident light in 1970. Then he could resolve the plane stress of each slab. However, we do not have a satisfactory theory to obtain a method of measurement and analysis of three-dimensional principal stress. In this paper we expand Aben's method and use it for the loaded plate model. Varying the wavelength of the incident light and measuring the polarization character along each axis x, y, and z in combination with interferometric photoelasticity produces a frozen stress medium. Then, using the analysis presented in this paper, we can provide information for the magnitude and direction of three principal stresses.

AUTHOR: YING Xuantong [2019 5503 0681]
XIA Shaofeng [1115 4801 6265]
JIA Yurun [6328 3768 3387]
ZHANG Zhiming [4545 1807 7686]

ORG: All of the Department of Physics, Fudan University, Shanghai

TITLE: "Laser Scanner for Computer-generated Holograms"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 315-322

TEXT OF ENGLISH ABSTRACT: Computer-generated holograms for optical spatial filtering drawn by a laser scanner have several advantages, i.e., they can be obtained directly with the proper size without further reduction photography, and the pixels of the hologram have gray scales. We have designed and constructed such a system that includes some modifications to meet the requirements of using simple and inexpensive optics as well as obtainable electronics. A field lens is adapted to keep the scanning beams almost fixed during their entry into the camera lens and hence it is unable to use a camera lens of f-number down to less than f/1:2. The reduction ratio of the dimensions of the input aperture to the final pixel is chosen to be 1:32, and the galvanometer-driven scanning mirror could cover the first sidelobes of the diffraction pattern of the input aperture. The system is driven by a compact CMOS electronics which is assembled in our laboratory, and used

[Continuation of GUANGXUE XUEBAO No 4, 1982 pp 315-322]

to control the scanning mirror and the acousto-optic shutter synchronously. The present setup has the following capabilities: (1) gray scale: 127; (2) spatial resolution: 10μ x 20μ; (3) size of the hologram in mm^2: 10.2 x 10.2; (4) space-bandwidth product: 1024 x 512; (5) time needed in minutes: 17. We have also fabricated several spatial filters for optical processing by using this system and the performances of such filters are presented.

AUTHOR: REN Bingfu [0117 4426 1788]
JIN Feng [6855 1496]
XU Mai [1776 6701]

ORG: All of the Changchun Institute of Physics, Chinese Academy of Sciences

TITLE: "The Determination of Refractive Index Profiles of Glass Waveguides Formed by Ion Exchange"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 323-330

TEXT OF ENGLISH ABSTRACT: The K_9 glass substrate made in China was dipped in silver melts at 270~300°C, the Ag^+-Na^+ ion exchange was made under constant temperature conditions, and the planar optical waveguides of graded index profile have been fabricated. Mode indices of these waveguide samples have been measured with a symmetric prism coupler at 6328 A laser wavelength.

In this paper, White and Heidrich's calculational formulas determining the waveguide index profile by mode indices have been reduced, and simple new methods determining the waveguide surface index by mode indices have been presented. On this basis, it is determined by mode index measurement values that the refractive index profile of K_9 glass waveguides formed by ion exchange is

$$n(x) = -(n_s - n_b)[(x/d) + \alpha(x/d)^2],$$

[Continuation of GUANGXUE XUEBAO No 4, 1982 pp 323-330]

where n_s = 1.5930 and n_b = 1.5146 are refractive indices of the waveguide surface and substrate respectively, α = 0.66 is the second-order term coefficient, d is the effective diffusion depth and x is the distance from waveguide surface.

For the second-order polynomial profile of optical waveguide index the mode equation and cut-off equation have been derived, from which the mode dispersion and cut-off properties have been analyzed and technical fabrication conditions of single-mode and multi-mode waveguides have been given.

Analytical results show that theoretical calculations are identical with experimental measurements. This paper provides necessary basic information for fabrication of single-mode and multi-mode waveguide devices required by optical fiber communication systems with K_9 glass waveguides formed by ion exchange.

AUTHOR: WU Minda [0702 2404 6671]
NI Shuhuai [0242 2885 2849]

ORG: Both of the Department of Optical Instruments, Zhejiang University, Hangzhou

TITLE: "Measuring the Flutter of Plane Model with Dynamic Shadow Moire Topography Method"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 331-340

TEXT OF ENGLISH ABSTRACT: This paper presents an optical method for measuring the flutter of plane model with dynamic shadow Moire topography. There are some advantages of this method in comparison with the electric method by using the acceleration sensor, such as getting all information of the measured surface instead of that from only several points, simplified testing process and, in particular, the information is recorded on film for reconstruction.

In this paper, the function of intensity distribution of Moire topography using the principle of light intensity and Fourier series expansion under any arrangement, and the formulas of the depth of Moire topography are derived. The errors of the formulas are analyzed. In order to satisfy the accuracy requirement, the error of grating pitch must be less than 0.02 mm.

[Continuation of GUANGXUE XUEBAO No 4, 1982 pp 331-340]

This paper also describes the principles and dimensions of an arrangement device in the test which, combined with shadow Moire topography and ZL1 high-speed camera, was used to measure the first and second order vibrations of the plane model. Data analysis of the maximum amplitude of 15 coordinate points, drawing of the "position-amplitude" curves for first and second order vibrations, as well as "time-amplitude" curves for second order vibration were made. We have compared the results of this method in accuracy with the electric method by using the acceleration sensor. The deviation of amplitude is less than ±0.03 along the spanwise center-line for first order vibration, and less than ±0.065 mm along the chordwise center-line for second order vibration on the measured surface of the plane model.

The results of the experiments show that this optical method can be used for measuring the flutter of the plane model, and its accuracy is quite satisfactory.

AUTHOR: QI Yu [7871 6877]

ORG: Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "The Contribution of Antireflective Film to the Color Restoration Characteristics of Photographic Lenses"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 341-348

TEXT OF ENGLISH ABSTRACT: According to the American color standard ANSI, the color restoration of photographic lenses is discussed in this paper.

The effect of light absorption of lens glasses on the color balance is pointed out and the function of antireflection coating to the improvement of color restoration characteristics of lenses is analyzed in detail. The color contribution of various kinds of antireflection coating is also calculated. The design, calculation and results of antireflection coatings for a 10x zoom lens are given. The results show that if the antireflection coatings are chosen reasonably, the transmittance and color restoration characteristics of lenses can both be greatly improved.

AUTHOR: YU Wenyan [1776 2429 3508]
WANG Guiying [3769 2710 5391]

ORG: Both of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "A Holographic Diagnosis of Laser Beams"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 349-354

TEXT OF ENGLISH ABSTRACT: This paper reports a holographic interference method for measuring the wavefront of a laser beam. A telescope is placed in an arm of the ring interferometer, so an expanded laser beam and a reduced laser beam are produced. These two beams should interfere and form a coaxial hologram. The curvature radius of the laser beam is obtained by measuring the localization of the reconstructed image. The measurement precision of the wavefront curvature radius corresponds to the depth of focus, three times higher than common interferometer. In addition, the pattern is direct, visual and spatially resolvable.

AUTHOR: XU Jialong [6079 1367 7127]

ORG: Xi'an Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Inquiry into the Design of Rotating Mirror House of the Streak Camera"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 355-359

TEXT OF ENGLISH ABSTRACT: The mirror house design at home and abroad has been reviewed simply in this paper. A new consideration for the design of the house is proposed, and analysis of the chief characters and application vista are given.

According to the optical principle of the streak camera, the coordinate equations of the image point have been derived before and after the plate glass is added. After the plate glass is added, the writing rate of the i age on the film track is given.

The calculation indicates: the larger relative aperture of the instrument, the thinner plate glass is allowed, the more rigorous the requirement of axial displacement. When the mirror rotates, the Δ-curve of the axial image points for different relative apertures is shown.

[Continuation of GUANGXUE XUEBAO No 4, 1982 pp 355-359]

Using the actual instrument, the performances of the instrument using a spherical cover or plate glass are compared. The defocusing of $\partial S'$ is critical data for the streak camera since it will directly affect the imaging quality of the instrument.

AUTHOR: LU Xiaojing [9310 1420 7231]
ZHAO Shuqing [6392 3219 3237]

ORG: Both of the Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Extraction of Directional Construction from Photograph by Optical Filtering"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 360-366

TEXT OF ENGLISH ABSTRACT: The directional characteristic of some objects is analyzed by means of $2D$ Fourier series. The Fourier coefficients have been numerically calculated for the typical objects, and by using optical filtering the objects are extracted from pictures. Then, optical directional filtering for the satellite-photograph is performed. Experimental results are given.

AUTHOR: JIANG Yasi [5592 0068 4828]
JIANG Fusong [1203 1788 2646]
GAN Fuxi [1626 4395 3588]

ORG: All of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Optical and Other Physical Properties of $Al(PO_3)_3$ Contained in Fluorophosphate Glass"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 372-379

TEXT OF ENGLISH ABSTRACT: Fluorophosphate glass is used as a kind of optical glass and laser material. Based on studying the formation and structure of $Al(PO_3)_3$ contained in fluorophosphate glass, in the present work the optical and other physical properties of the glass have been investigated. The low $Al(PO_3)_3$ content fluorophosphate glass, in which the network structure has been seriously destroyed, is located in the destroyed region, while the variation of the glass properties and the effect of various fluorides on the properties are similar to those of the oxide glass in the destroyed region. The special role of LiF, MgF_2 and AlF_3 is also reflected in the variation of the physical properties. Moreover, compared with silicate and borate glasses with high contents of the former glasses,

[Continuation of GUANGXUE XUEBAO No 4, 1982 pp 372-379]

the electrostatic attraction between cations and anions plays a more important role in the variation of the properties of the fluorophosphate glass with low $Al(PO_3)_3$ content. The position of the studied glass in n vs ν diagram is plotted, the partial properties of the studied glass are given and compared with some data in the literature, and the variation of the partial properties is related to the $Al(PO_3)_3$ content.

AUTHOR: HUANG Guosong [7806 0948 2646]
CHEN Shizheng [7115 0013 2973]

ORG: Both of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Thermo-optic Properties of Optical Glass"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 4, 1982 pp 380-384

TEXT OF ENGLISH ABSTRACT: In order to minimize the influence of the environmental temperature on optical components, thermo-optics coefficients W, P and Q that describe the variation of optical properties of optical glasses at a certain temperature are introduced. The methods of measuring some optical glasses in respect of their coefficients are described and the results are given. This paper ends with a discussion of the possibility of reducing the influence of thermal disturbance on optical components.

9717
CSO: 4009/372

AUTHOR: SI Wei [1835 4850]

ORG: None

TITLE: "The Fourth Conference of Central South Five Provinces (Regions) Printing Technology Cooperative Group Held in Guangzhou"

SOURCE: Beijing YINSHUA JISHU [PRINTING TECHNOLOGY] in Chinese No 4, 1982 p 3

ABSTRACT: The Fourth Conference of the Central South Five Pronvinces (Regions) Printing Technology Cooperative Group and the Graphic Plate-making and Printing Experience Exchange Meeting were held jointly in Guangzhou on 5-11 May; 69 delegates representing 44 bureaus of publications, related departments, and printing plants attended. The delegates agreed that as all of this year's projects of the cooperative group have been completed rather satisfactorily, the future goals of the group should be to strengthen staff training, to extend new techniques, to strengthen industrial management, to improve the quality of products, and to shorten the publication cycle. There should be more exchanges of experience on specific techniques. Many forms should be adopted to extend the advanced experience of local plants. The conference assigned 7 items of exchange for 1982 and the provinces (regions) to be responsible for the respective item. The Fifth Cooperative Group Annual Conference will be held in Zhengzhou in Apr 1983.

6168
CSO: 4009/381

AUTHOR: None

ORG: Conference for the Establishment of a National Printing Industry Science and Technology Information Network

TITLE: "National Printing Industry Science and Technology Information Network Conference"

SOURCE: Beijing YINSHUA JISHU [PRINTING TECHNOLOGY] in Chinese No 4, 1982 pp 2-3

ABSTRACT: The National Printing Industry Science and Technology Information Network Conference, sponsored by the National Bureau of Publications, was held in Kunming City of Yunnan Province on 21-26 May 82. Participants included 57 delegates representing the bureaus of publication of the 28 provinces, cities, and autonomous regions, the 13 research institutes of printing technology, the China Printing Company, the China Printing Material Company, the China Printing Technology Association, Beijing College of Printing, and Shanghai School of Printing. This was the first national conference concerning the work of information of printing technology. The National Printing Industry Science and Technology Information Network Charter (Draft) was discussed, revised, and finally unanimously approved by the delegates. The first group of information stations are to be established at the China Research Institute of Printing Science and Technology, and the Research Institutes of Printing Technology of 12 provinces. The Information Network was officially declared as having been established. The network will,in forms of journals and express reports, disseminate information materials, research reports, etc. to the various informa-

[continuation of YINSHUA JISHU No 4, 1982 pp 2-3]

tion stations. It was agreed that the Central Station, which is the China Research Institute of Printing Science and Technology, and the information stations of Liaoning and Shaanxi will be responsible to organize an editorial committee of the network journal. The establishment of a technical consulting service was also discussed. The delegates agreed that at present the task of strategic importance is to train and organize a group cadres with skills of gathering and disseminating scientific and technological information.

END

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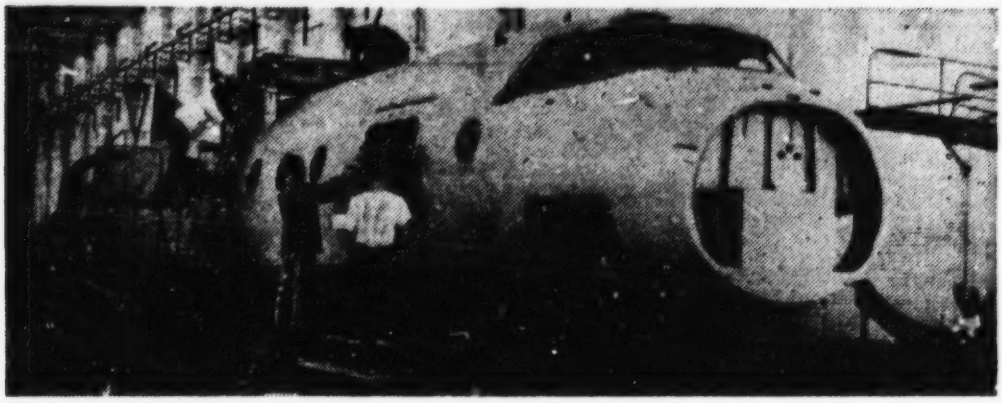
APPLIED SCIENCES

XI'AN AIRCRAFT PLANT TURNS OUT NEW 'Y-7' TRANSPORT

Xi'an SHAANXI RIBAO in Chinese 21 Aug 82 p 1

[Photograph caption]



With the approval of the State Council and the Central Military Commission, batch production of the "Y-7" transport aircraft is now underway. Shown in the protograph are personnel of the Xi'an Aircraft Manufacturing Company working on the fuselage assembly.

CSO: 4008/225

APPLIED SCIENCES

A SURVEY OF FUSION REACTOR DESIGN STUDIES

Chongging HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese, Vol 1, No 1, 1981, pp 1-10

[Article by Huang Jinhua [7806 6930 5478] and Deng Poquan [6772 2672 2938]: "Description of Fusion Reactor Design and Research"]

[Text] The first part of this article describes some of the physical, structural, heat release and environmental safety characteristics of fusion reactors by comparing them with fission reactors. The second part discusses the content and progress in fusion reactor design and research and problems in reactor plasma physics, heat release, maintenance and repairs.

It is expected that the realization of controlled fusion will have to demonstrate its scientific feasibility, engineering feasibility, technical feasibility, economic feasibility, environmental safety and its feasibility for commercialization.

In recent years, experiments in plasmas have realized encouraging progress. International research and planning are still in a stage of demonstrating their scientific feasibility. But the topics of engineering feasibility and technical feasibility had already begun at the end of the 1960s. Conceptual design of the fusion reactor has realized a lot of progress. Economic and environmental problems have also been considered and such consideration has deepened.

I. Some Characteristics of the Fusion Reactor

In nuclear reactions, the fusion reactor can be divided into two parts, the core and the envelope. In the core, the energy released by fusion is mainly brought out by fast neutrons of 14.1 mega-electron volts. In the envelope, the energy of the neutrons deposits and produces tritium or fission fuel. This can solve the long-term needs for energy, and the fusion reactor has many characteristics when compared to the fission reactor:

1. Neutrons are abundant. The energy from one nuclear fusion reaction is smaller than that from a fission reaction by one magnitude. With the same

power, the reactivity in the fusion reactor is much larger. The number of neutrons provided in addition to those needed to maintain themselves per unit time interval is about 10 times larger than the fast neutron breeder reactor. The time for fuel multiplication is about 1/10 that of the fast neutron reactor.

2. Fusion and neutron reactions (energy deposition and capture absorption) occur separately in the core and the envelope. The power density in the envelope is low and uneven.

The neutron flux rapidly drops as the neutrons move further away from the neutron source in the core. The power density on the first wall facing the plasma is the greatest. The load on the neutron wall is defined as:

$(P_w)_n$ = fusion neutron stream Jx14.1 mega-electron-volts, megawatt/square meters. The main purpose of studying fusion reactor materials is to develop materials that can reach a higher megawatt-year/square meter value. Because it is difficult to maintain and replace the parts in a fusion reactor (especially the tokamak reactor), the useful life of the first wall must not be too short. This limits $(P_w)_n$, thus the power density in the envelope is low (See Table 1).

The above characteristics form some of the differences between a fusion reactor and a fission reactor.

(1) The building cost of a fusion reactor is high, but visible progress in the improvement of the economic performance in design and research has been realized (See Table 2). The building cost of the reactor is far greater than that of the fission reactor, but it does not constitute a major portion of total construction cost.

Table 1. Thermal Engineering Parameters of Various Types of Reactors.

	Average power density in core watt/cubic centimeter	Maximum surface heat load watt/square centimeter
High temperature air cooled reactor	8.4	58
Air cooled fast reactor	240	184
Sodium cooled fast reactor	360	259
Pressurized water reactor	100	176
Fusion EPR	5	23

For the fusion reactor, the values are those of the envelope.

Table 2. Capital Construction Cost U$$/kilowatt [1]

	Reactor system	Rest of power station
Fusion reactor UWMAK-1, 1,500 megawatts of electricity (designed in 1974)	1000	800
ORNL/DEMO design, 750 megawatts of electricity (1977)	450	800
Sodium cooled fast reactor, 1,200 megawatts of electricity	100	700
Pressurized water reactor, 1,000 megawatts of electricity	75	525

(2) The exit temperature of the coolant can be very high. The temperature of the structural material of heat releasing components inside the reactor Tw is determined by the temperature Tc of the coolant at that locality, the heat load q and the coefficient of convection heat conduction h, i.e.:

$$Tw - Tc+q/h$$

The allowable operating temperature of the material limits the temperature the coolant can reach. Because the distribution of q is very uneven, a low temperature coolant can be used first to cool the first wall which has a high q value. Then the coolant can be allowed to flow towards the region where the value of q drops and where a higher Tw is allowed (because the intensity of neutron radiation also drops), thus realizing a high exit temperature. It is hopeful that this can be used to produce synthetic fuel and to generate electricity from magnetic fluid.

(3) Fission fuel ^{239}Pu and ^{233}U can be produced in a versatile manner in one reactor.

3. Environmental and safety problems. In fusion reactor accidents, spilling of liquefied metals may occur, the magnet may malfunction, the power and the flow of coolant may be imbalanced, and plasma confinement may be destroyed.

Because the relative harmfulness of radioactivity from fission products and the actinium group elements formed by heavy nuclear transmutation is high and the half life is very long, the relative harmfulness of radioactivity of the fission reactor is estimated to be several magnitudes higner than that of the fusion reactor, and the safe storage of radioactive waste of a long life also needs to be solved well. Because critical nuclear accidents will not occur in the fusion reactor, because the power density is lower, and because the power is also low after reactor shutdown, people commonly believe that fusion reactor accidents are less dangerous. The daily leakage of radioactivity of both are about the same. The fusion reactor mainly leaks tritium. Molecular tritium actually does not dissolve in human tissue. People directly exhale 98 percent of the tritium inhaled. It is relatively harmless but tritium liquid is more harmful. The quantity of solid radioactive waste produced by a fusion reactor (mainly replaced parts) is large, and it cannot be treated by concentration.

4. The structure of the tokamak fusion reactor is complex and maintenance is difficult. This is mainly because of its ring geometry, the small ring-radius ratio R/a, the chaining of the coils of the ring field and the polar field, the high degree of vacuum created by hermetic welding, the large numbers of entry and exit pipes for the coolant, and the large facilities surrounding the reactor such as the neutral injector, etc. During maintenance, remote operating facilities are used. The vacuum welded seams are cut open via tubes that are not too large, and the joints of the coolant pipes are dismantled. The parts that need to be replaced are taken out. It may require more than 100 days from the time maintenance begins to the time the reactor is restored to its original operating status.

5. Intermittency. The tokamak plasma current is produced by induction. At present, it can only be sustained for a period of time. Also, there is the problem of accumulation of impurities in the plasma and operation is intermittent. However, the production and output of electric energy can be stable. This can be maintained by storing some high temperature coolant in the circuit or by simply utilizing the thermal capacity of the coolant itself. How to maintain stability of the tokamak or realize long operating pulses is an important question in reactor research.

6. The general course of development of reactors is to build an experimental reactor (ETR), an experimental propulsion reactor (EPR) of several dozen megawatts in scale, commercial demonstration reactors of about 200 megawatts of electric power (DEMO), and then a commercial reactor. Such fission reactors have very different dimensions, therefore the building costs are also very different. The dimensions of the different stages of fusion reactors are almost the same. The larger the experimental fusion device, the smaller the designed dimensions of the reactor as shown in Figure 1 [2]. Design research shows that the dimensions and the building cost of reactors ranging from several dozen watts to 1,000 megawatts of

electricity are about the same. The fusion reactor regulates the total power via the load on the neutron wall.

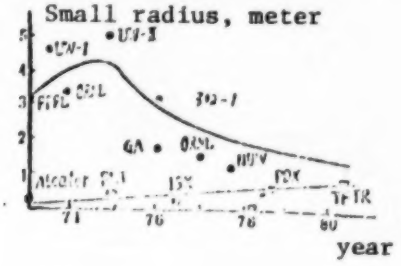


Figure 1. Developmental trend of the size of fusion devices

II. Design Research of a Fusion Reactor

1. Conceptual Design and System Research for a Fusion Reactor

From the end of the 1960s, people began broad and in-depth studies of the fusion reactor. It seems that the commercial reactor that was finally build will not encounter any unsurmountable difficulties, but undoubtedly, a lot of manpower and materials and a long time (for example, about 30 years) will have to be invested before this can be realized. Reactor research can generally be divided into two closely related aspects: design research of the reactor power station (including systems research) and special technology research. Special technology research includes superconductive magnets, materials and tritium. Through design research, several dozen conceptual designs have been proposed for the reactors of each step based on various types of magnetic confinement configurations and laser fusion. After efforts in design and computation by specialized personnel in various fields, and after mutual coordination, designs from the parameters of the plasma to the structural draft and the general layout can provide as completely as possible a basis for a general view, performance and design as well as economic analysis and environmental safety analysis. Such a complex facility that combines many technologies has many problems that need to be solved. For this, many hypotheses have to be introduced into the design, for example, the selection of criteria for the coefficients of plasma transport, the selection of various computational formulas and parameters needed in the design, the hypothesis that remote vacuum sealed welding operations can be realized, etc. Many factors have to be gradually determined in reactor technology research. Therefore, technological research subjects and the range of parameters in research can be found in conceptual designs. Progress in reactor technology research will also change conceptual designs. Through mutual stimulation, the goal of building the reactor can be realized.

The purpose of the conceptual design of a reactor is not to provide a design for a reactor that is about to be built. It is to investigate clearly which technological problems have to be solved and the relative importance of these problems, and to propose a design plan that will solve the problems and thus help form and implement research planning for fusion reactors. Conceptual designs can serve as a reference used to measure the effect of new technological data and new ideas on the performance of the reactor. It provides a foundation for systems research.

Systems research of a reactor involves a comparative evaluation of different design concepts and selections. Economic factors (such as the price of electricity) are used as the quality factors for comparison and optimization. This requires the establishment of a model that describes every part and a computational program that describes the entirety of the power station on this foundation. The computational results show changes in the performance of the power station and its economic data along with certain key factors.

Since the 1970s, reactor design work has made relatively great progress. This is mainly because the scale of reactors has been reduced, their economic properties and maintainability have improved, their technological requirements have been reduced, many designs of various types of reactors have been proposed, and analysis has delved into such questions as their economic properties, safety and environmental impact.

As a rough estimate,

the total building cost of a reactor system $\propto$ size of the reactor structure $\propto$ (radius a of the plasma)^2 x total thickness of the envelope Δ ,

$$\text{Building Cost per unit electric power of the reactor} \propto \frac{\text{size of reactor structure}}{\text{power of reactor}} \propto \frac{\Delta}{P_v a} \propto \frac{\Delta}{P_w} \qquad (2)$$

Δ includes the thickness of the envelope, the shield and the magnet; P is the average power density of the plasma. Increasing the load on the wall Pw can reduce the building cost per unit electric power of the reactor. Under a fixed Pw, increasing Pv can reduce a and thus reduce the building cost of the reactor system, and at the same time, the scale of the reactor can be reduced (dimension and total power). This is very meaningful. The scale of previous designs was large and engineering and technical problems were difficult. Figure 2 [3] and Table 3 show some visible differences in tokamak designs of the past several years. Because $P_V \propto n^2$, $P_W \propto an^2$, $n\tau \propto n^2 a^2$, it is beneficial to increase the plasma density n, which is limited by the allowable β value. Increasing the value of β is a goal of research in plasma physics. This requires reducing the ring-radius ratio A, the safety factor q, and increasing the allowable polar β value.

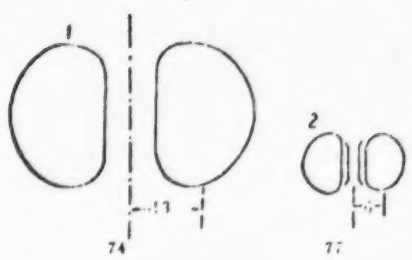


Figure 2 . Change in the scale of Tokamak designs

1. a=5 meters; Pw=1 megawatt/square meter; P=1,700 megawatts of electricity.

2. a=1.5 meters; Pw=5 megawatts/square meters; P=750 megawatts of electricity.

Table 3. Changes in the scale of Tokamak designs

	UWMAK-1 of 1974	After 1977
Large radius of plasma	13 meters	5-6
Small radius of plasma	5 meters	1.2-1.5
Dimensions of magnet	15x22 meters	3.5x8
Pw	1 megawatt/square meter	2-5

Simplifying equations (1) and (2) gives a rough estimate, and more factors must be considered. For example, increasing Pw requires the use of a strong and more costly magnetic field, and replacement of the first wall will be more frequent. Also, for example, under a fixed Pw, increasing the β value to reduce the strength of the magnetic field needed can reduce building

cost but as the cost of construction of the coils of the magnetic field as a percentage of the total construction cost drops, the benefits from an increased β become less obvious. Systems research in GA gives us Figures 3, 4 [4]. The conclusion is that the Pw of the non-circular section reactor considered for GA can be taken as 2 megawatts/square meter, and β should be (10-20) percent. This is an example of systems research work.

The maintainability of the tokamak reactor has been greatly improved. The vacuum wall is moved outward from the position of the first wall. For example, moving it to the outer surface of the shield can simplify maintenance work. The number of coils of the main magnetic field is lessened to the number allowed by the degree of rippling. The polar field coil is placed on the outside of the coils of the main magnetic field as much as possible.

Technological requirements have been lowered. For example, research by ORNL has proposed the use of microwave to preheat electrons and this may lower the ring voltage needed by one magnitude. Consideration has been given to the mechanism of fuel dispersion. The required depth of penetration of pellet feed can be greatly reduced. Because of heating of a particles at the center of the plasma is concentrated, heating by a neutral beam may not have to penetrate the highly dense region. In this way, the required beam energy can be greatly reduced.

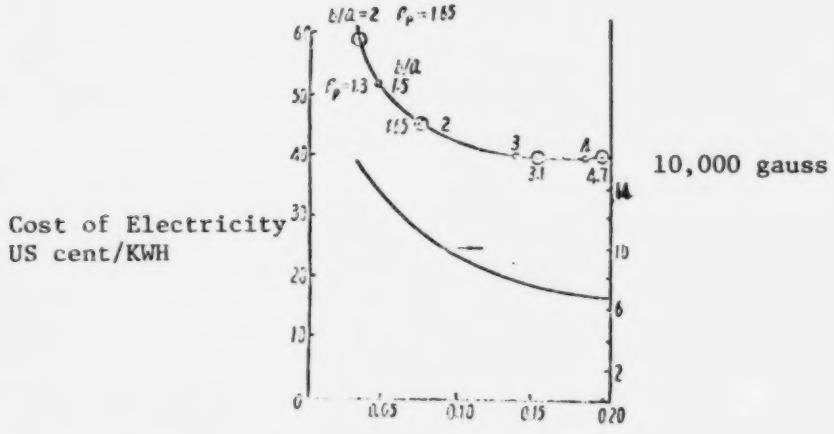


Figure 3. Change in the price of electricity with β values

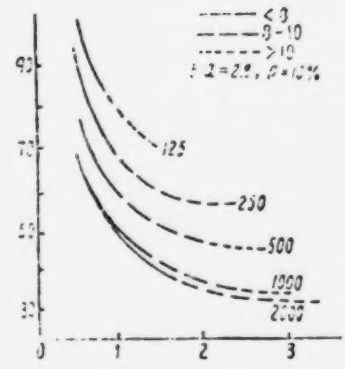


Diagram 4. Changes in price of electricity along with load of wall and total power

2. Some Questions in Plasma Physics in the Operation of a Fusion Reactor.

(1) The problem of startup [5-8]. Startup includes ionization and excitation of electric current. The rise in current finally establishes the specified operating current and appropriate use of auxiliary heating produces ignition. In view of present experiments, several hundred volts of ring voltage are required to overcome bremsstrahlung of small amounts of light impurities (such as oxygen) and blocking of linear radiation. Under reactor conditions, the pulse current density allowable by the technology of the superconductive ohm heating transformer limits the ring voltage to reach only about 50 volts. Although we can use low density startup to reduce the n^2 term of loss, the problem of escaping electrons exists. If the electrical field is too weak, discharge heating will not be fast enough, and because of loss due to dispersion by the resistor, a part of the volt-second count will be lost, therefore it is expected that in the future, several dozen megawatts of radio frequency power must be supplemented at the beginning of discharge so that the lowest electrical field required to produce an avalanche of electrons can be realized. For a discharge of a limited q value, the maximum ohn heating power $\propto (B_\tau /R)^2$. The larger the large radius R, the poorer the ohm heating effect. The electron temperature and the electrical current cannot be quickly established. Perhaps, a low power radio frequency heating has to be added at the beginning of startup. This is estimated to be about the same magnitude as the ohm heating power. But, it cannot be too large, otherwise the skin effect will become serious.

Within the dimensions of the reactor, the skin effect will influence the current density and cause it to rise at the center because the electromagnetic field requires a fixed time to penetrate the center of the plasma. Therefore, the small radius must be smaller at the beginning of discharge, then a moveable aperture can be used following a definite procedure to allow a and the intensity of the total current to increase simultaneously. But if a is too small at the beginning moment, injecting more gas may possibly cause the loss to surpass the Murakami limit

$$n_c < 1.5 \times 10^{20} B_\phi \ (10{,}000 \text{ gauss}) / (qR(\text{meter}) Z_{eff}) \qquad \text{meter}^{-3}$$

and thus bring about a break in the discharge. The initial intensity level of the neutral gas greatly affects the development of discharge. The minimum ionization time measured by A. Buffa et al was done under a pressure of 5×10^{-5} torr in the filling gas. This is most favorable to producing an avalanche of electrons.

The problem of using auxiliary heating to reach ignition and controlling the distribution of combustion: High power neutral injection and radio frequency heating are considered the most promising means of auxiliary heating in a reactor at present. But, the neutral beam based on the positive ion source used at present has become unfavorable in reactor conditions because the injection power achieved in a unit volume of plasma will unavoidably weaken along with increases in the volume and density of the plasma. This is because

(a) the ratio of the surface area of the plasma Σ_p and the volume of the plasma V_p is $\Sigma_p / V_p \propto 1/a$;

(b) to avoid heating only the neighborhood of the surface, the center of the reactor level plasma typically of a density of 10^{14} centimeters $^{-3}$ and a radius of 1 to 2 meters must be penetrated. The energy of the beam (deuterium) particles must at least be larger than 200 kilo-electron volts. The efficiency of neutralization of the beam of positive ions within such a high energy range is greatly reduced (the section of neutralization reduces), see Figure 5. It can be approximately represented as

$$\eta(E) = \left[1.0 + 3.0\left(\lg \frac{E}{4 \times 10^4}\right)^{10}\right] \times 10^{-0.873(\lg E - 4.3)^3} - 0.016$$

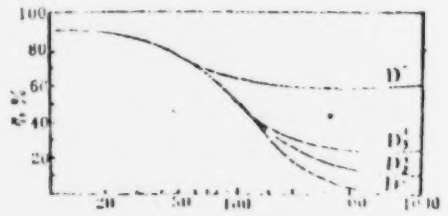
(E>10 kilo-electronvolts)

For example, in present experiments, E=70 kilo-electron volts, $\eta \approx$ 70 percent, and under reactor conditions, E=200 kilo-electron volts, and $\eta \approx$ 18 percent.

The power that can be injected into a unit volume of plasma is

$$P_{inj} = (2/a\kappa) \cdot \sqrt{(1+\kappa^2)/2} \cdot C_p \cdot j_b \cdot E \cdot \eta(E)$$

where E is the beam energy; η (E) is the efficiency of neutralization; C_p is the ratio between the area of the whole injection window and the surface area of the plasma; j_b is the current density of the beam. It is limited by the limits of the spatial electric charge, $j_b \leq 2.7 \times 10^3$ amperes/square meter; κ is the ellipticity. For the reactor, the radius of the plasma a is larger, thus the way to increase P_{inj} is to increase η (E). Therefore, we need to develop a source of negative ions. Its efficiency of neutralization within this energy range can still reach 65 percent. Another possible way is low density startup. Only 150 kilo-electron volts are required for penetration, then the density can gradually accumulate. When ignition occurs, the power produced by fusion will mainly be concentrated at the center, and a very high beam energy will not be necessary for penetration into the neutral region.



A. Energy of the beam particles, kilo-electron-volt

Figure 5. Change in neutralization efficiency along with changes in the energy of the deuterium beam particles.

The heating efficiency of radio frequency is higher. Radio frequency heating has a better spatial versatility and it does not require a very large opening. This is favorable to satisfying thermal stability requirements in controlling the temperature distribution on the section and in controlling combustion.

(2) The problem of instability of combustion heat and its control. It is always hoped that before ignition of a reactor, plasma confinement can be maintained well as much as possible so that auxiliary heating will be more economical. But when the temperature surpasses ignition, some common concepts are reversed. At this time, if energy confinement and particle confinement are too long, they will possibly lead to the development of thermal instability. If Alcator calibration is still maintained after ignition, the control of combustion will encounter definite difficulties. This is equivalent to the presence of a positive temperature coefficient. Disturbance of temperature by combustion is unstable. We must think of a

way to regulate the rate of loss in plasma transport or the rate of thermonuclear reaction from the outside. The preliminary ideas are: (a) Reduce the evenness of the ring field to strengthen ripple dispersion, this means reducing the number of coils in the ring field and adding some compensatory coils that can be regulated in a versatile manner so that the degree of rippling in the ring field can be appropriately regulated. (b) Theory predicts that when the temperature of the plasma rises and surpasses β_{max}, nonlinear turbulence will occur and it may possibly lead to a kind of mechanism that will automatically regulate the rate of energy loss. (c) We can regulate the ratio between the rate of feeding and mixing under our control and thus regulate the rate of thermonuclear reaction.

(3) On the control of impurities and the removal of residual ash. Experiments show that the polar-bias filter is effective. But it will also lower the combustion rate and in particular, there are many engineering and technological difficulties. Another thought is to introduce a cold plasma shield, but whether this configuration can exist stably involves the question of balance of various kinds of flow.

(4) The question of feed [9] A fusion reactor requires additives to supplement internal fuel consumption of the reactor plasma. For example, when it operates at a density of 2×10^{14} centimeters $^{-3}$, it is estimated that the supply of fuel required will be 4 grams/megawatt day. Then, for a reactor with a thermal power of 3,000 megawatts, the rate of feed will be 12 kilograms/day. This requires from a dozen or so to several hundred independent injectors. Among the feeding plans currently being studied, injection of pellet feed has been studied the most. Pellets are generally crystals of $A>10^9$ amu with a diameter >5000Å. The advantage of pellet feed is that the fuel can be deposited in the central area of the plasma. The following series of questions must be answered in theory and experiments: (a) How are the pellets manufactured? (b) What is the life and the rate of evaporation of the pellets in the fusion plasma environment? (c) What will be the effect of the introduction of pellets upon the plasma? (d) What velocity can the pellets be accelerated to? What method can be used?

P.D. Parks et al started out from the neutral melting model and took into consideration the shielding effect and derived the rate of evaporation of pellets expressed in the following formula

$$dr_p/dt = -1.58\times10^{-8} r_p^{-2/3}(\text{cm}) n_{eo}^{1/3}(\text{cm}^{-3}) T_{eo}^{1.64}\ (\text{electronvolt})\ \text{cm/second}$$

where r_p is the radius of a pellet; n_{eo}, T_{eo} are respectively the electron density and the electron temperature in the plasma. It coincides well with experimental data. Experiments showed that the introduction of pellets did not cause visible energy loss in the plasma and the density increased several times. Such feed is effective.

(5) The problem of stable operation. There are several ideas on extending the plasma current of the tokamak reactor to produce long pulses or to realize stable operation: (a) using neutral beam injection to provide movement to produce the plasma current and at the same time to partially supplement fuel; (b) using radio frequency for heating and relying on the movement of microwave radiation to drive the plasma current; (c) using escaping electrons to provide the plasma current because their frictional resistance of coulomb collision in the plasma is very small, i.e., they have a very low plasma electrical resistance and it is hoped that they can extend the time of attenuation of the current.

3. Problem of Heat Conduction in a Fusion Reactor

(1) The envelope. The envelope (especially the first wall) is closest to the plasma. High temperature and strong radiation may cause a greater degeneration of thermal and mechanical properties of the materials. In the pulse type reactor, fluctuation in temperature of the materials is also great and this will cause serious fatigue problems. The temperature gradient here is also large and it should be reduced in design.

Because of the ring geometry of a small ring-radius ratio, positioning the cooling pipes in the tokamak reactor is more difficult. Problems in designing the heat dissipation system of the envelope and the envelope modules and maintaining performance are combined to become a key problem in design. This constitutes one of the characteristics differentiating various conceptual designs.

(2) The protective layer of the first wall. To reduce the burden of the first wall and to reduce the effects of impurities, the design frequently uses wall curtains made of C or SiC. These materials that are tolerant to high temperatures allow radiation to pass through and transmit heat, but we must prevent the temperature from rising too high and cause sublimation or the occurrence of chemical reactions with hydrogen isotopes. The temperature difference between the materials connected by the high temperature protective layer is large and this problem must be solved well. The protective layer can reduce the amplitude of fluctuation of temperature on the first wall as shown in Diagram 7 [10] and thus ease material fatique.

(3) The bias filter's gathering wall. It is bombarded by charged particles from the bias filter. This part of the energy flow is very different in different designs. The heat load on the wall may be very large, causing difficulty in heat dissipation.

(4) Superconductive magnet. Its temperature has to be maintained below the critical temperature. In the tokamak reactor, the energy stored in the coils of the main magnetic field can reach 10^5 megajoules. In low temperatures, the specific heat of the materials is almost zero. This means that a small heat fluctuation will cause a large temperature fluctuation, and we need to take stabilizing measures to guarantee safety when local loss of

superconductivity occurs. The magnet must be cooled. When the temperature is very low, such as at 4 ^{o} K, the deposited heat must be released and this uses a lot of energy. For example, the release of 0.2 megawatts of power uses about 80 megawatts. Therefore, the magnet needs sufficient shielding.

Besides the loss of superconductivity by the superconductor, a breakdown of the cooling pump, a short circuit or a break in the circuit, puncture of insulation will all cause an accident in the magnet. At this time, the problem of transferring a very large amount of energy stored in the magnetic field must be handled well.

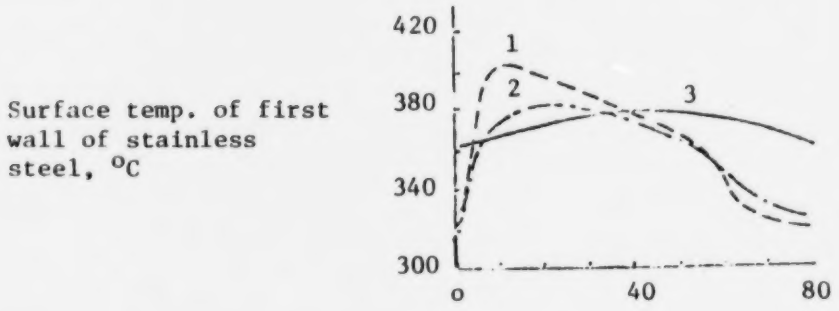


Figure 6. Temperature fluctuation on the first wall in the cycle when the protective layer reduces

1. Exposed wall; 2. Coverage of the graphite limitator 10 ; 3. C lining

4. Maintenance of a Tokamak Reactor

The first generation fusion fuel is deuterium-tritium. The reaction produces neutrons. This necessitates remote operations for maintenance of the reactor. The shutdown time of the reactor for maintenance is determined by accessibility of the parts that need maintenance or replacement and the maintenance equipment available for use and it directly affects the economic nature of commercial reactors and time utilization. Accessibility is an important property of the fusion reactor. It is related to the characteristics of the design of the envelope, the number of coils of the main magnetic field, the number of coils of the polar field and the arrangement of peripheral equipment of the reactor.

There are several choices for positioning the wall of the vacuum chamber as illustrated in Figure 7. The secondary vacuum wall allows penetration at a low rate of gas leakage. It can lower the required capacity of the main vacuum pump.

The efforts of [11,12] gave a detailed comparison of several typical reactors. The important points related to maintenance are listed in Table 4, and referring to Figures 8-10, the comparative studies provided computational results shown in Figure 11 and Table 5.

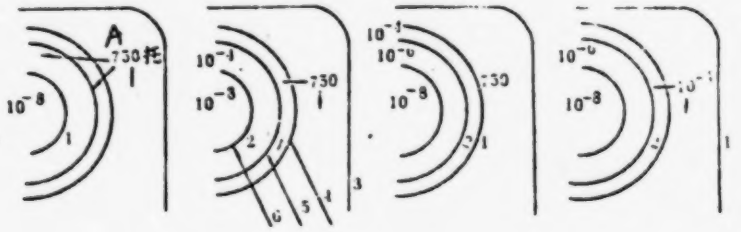


Figure 7. Position of the wall of the vacuum chamber

1. Main vacuum wall; 2. Secondary vacuum wall; 3. Reactor chamber; 4. Supporting panel on the side; 5. Exterior of the shield; 6. Front end of the envelope module. A. 750 torr.

Table 4. Characteristics of replacing designed modules of several reactors

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1. Type of module
2. Large replacement module
3. Medium
4. Small
5. Design
6. Item
7. Thermal power, megawatt
8. Number of coils of main magnetic field
9. Number of modules
10. Weight of module, ton
11. A type 50 tons, B type and bias filter 8 tons
12. 380 kilograms
13. Size, meter

14. 0.7 diameterx0.36

15. Length 7-16

16. Removal of the module

17. Entire fan section (with the TF coil) is moved to the heat chamber by a special large cart running along tracks.

18. The outer shielding door is opened and the fan section (not including the cork shaped module of the bias filter) is moved out radially while the TF coil is not moved.

19. The outer shielding door is opened at top and bottom and module A is taken out, then the other modules are taken out.

20. The top vacuum hole is opened, the remote operating equipment is inserted into the plasma chamber from here and the modules are replaced inside the chamber.

21. Cassette type modules are removed from between the TF gaps, the modules along the radial direction of the small ring are separated into three layers, those in the inner layer are replaced most frequently.

22. Position of the main vacuum chamber

23. Front end of module

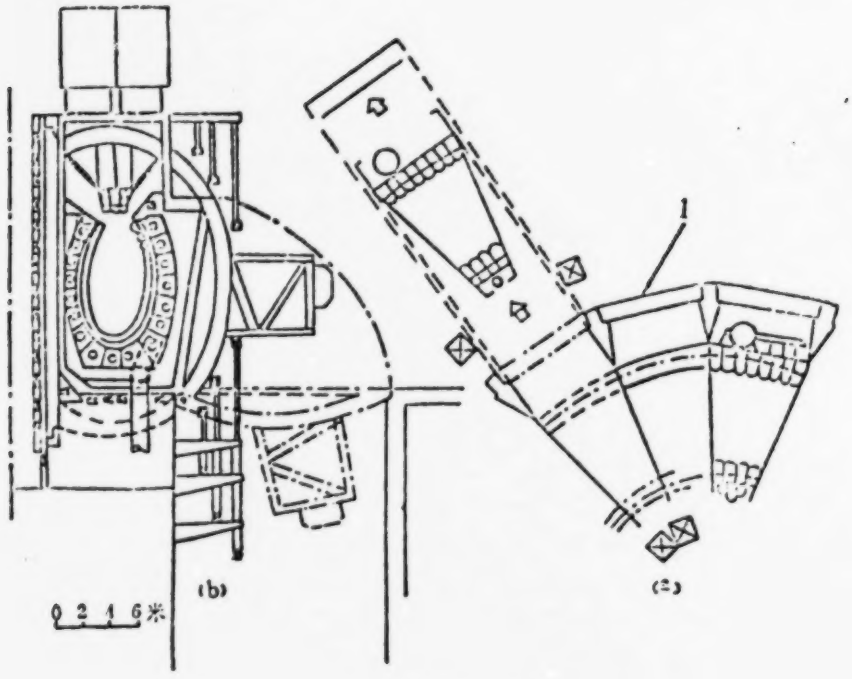
24. Outer shield

25. Back end of module

26. Back end of module

27. Wall of the hermetic chamber of the reactor

1	2 大型装置设计		3	4 公	司
5 / 6	UWMAK-I	Culham I	UWMAK-II	GA-DPR	ORNL
7	5000	5000	5000	1001	1000
8	12	12	13	16	13
9	12	12	90	2000	510
10	3500	300	11 A 60 B	12 350公斤	3—5
13	26×15×12	15×10×6		14 0.7直径×0.35	15 0.7—15
16	17	18 TF	19	20	21
22	23	24	25	26	27



1. Outer shielding door

Figure 8. Illustration of the Culham-II structure

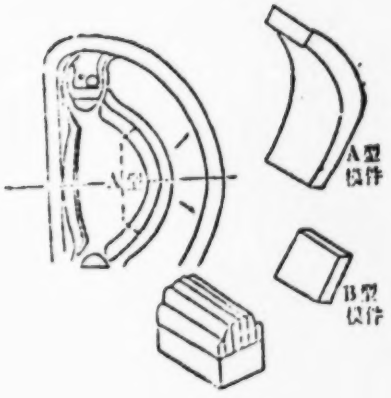


Figure 9. Illustration of the structure of UWMAK-III
A type, A type module, B type module

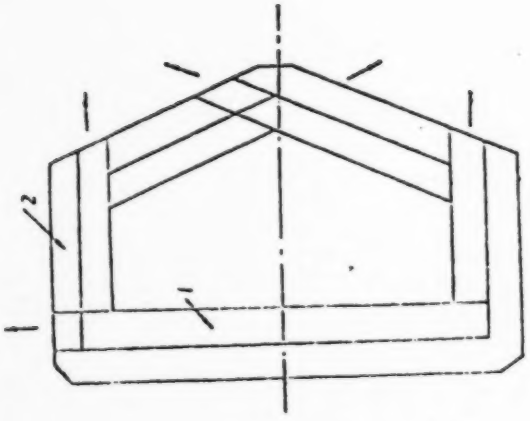


Figure 10. Illustration of the structure of the ORNL envelope layer 1. Moveable envelope layer module; 2. Fixed shielding layer.

Table 5. Data related to the designed maintenance of several reactors

1. Design
2. Item
3. Proportion of the whole reactor during each replacement
4. Number of days needed for maintenance
5. Maintenance intervals, day
6. Time utilization rate,
7. Number of days needed for unscheduled maintenance
8. UWMAK-I, 5000 megawatts
9. UWMAK-I, 3000 megawatts

1	2 / 3	4	5	6	7
8	[illegible]	1/12	134	733	[illegible]	
9	[illegible]	1/12	134	~900	80	
[illegible]		1/12	47	372	74	17
[illegible]		13/18	111	957	73	11
GA		600/2000	214	930	84	
GA*		400/2000	53	474	76	7
ORNL		6/18		~350	72	31

* [illegible]

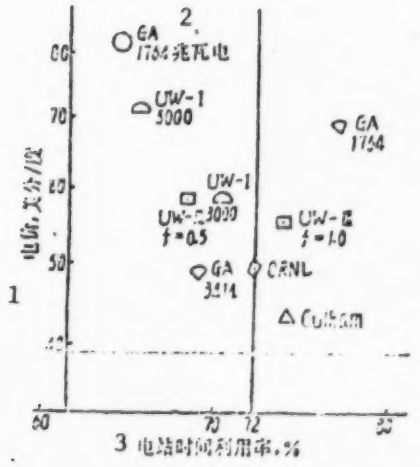


Figure 11. The price of electricity of the power station and time utilization rate

1. Price of electricity, US$ cents/kilowatt-hour

2. 1764 megawatts of electricity

3. Time utilization rate of power station, %

The goal of a time utilization rate of 72 percent in Figure 11 is feasible for the fission reactor power station. The target for the price of electricity is the expected data for the coal-fired power station in the year 2000.

The conclusion is that (a) based on such a design, the price of electricity will be higher than that of a thermal power station, (b) it is hopeful that the time utilization rate of reactor stations with large, medium and small modules can reach 72 percent; and (c) the number of days required for maintenance is 50 to some 100 days.

The results of comparison show that the Culham-II is more favorable to maintenance, and work on this basis [12] has proposed an improved design. The improvement mainly involves automation and combining the series of time consuming work of making a passageway. Diagram 8b shows the improved design for making a passageway. After improvement, the time to open the shielding door, the sideways supporting panel and the neutral injector required is only 13 hours. Therefore, the total amount of time needed is reduced to 300 hours. The time utilization rate of the improved design is 79.7 percent, and the price of electricity can also be reduced to below that of thermal power stations.

5. The tokamak reactor may very possibly be used for the first generation fusion power station, but it has some stubborn difficulties: the specific pressure value β is low and it requires a strong magnetic field; the structure is complex, maintenance is difficult; pulsed operation requires a system to store and transport energy, and this causes problems of fatigue in structural materials. Some other types of reactors are superior in these aspects. The design research work for these reactors are also being actively carried out.

(1) Serial Magnetic Mirrors. LLL research believes the energy gain $\underline{0}$ of serial magnetic mirrors can reach 10. They are suitable for building mixed type reactors. In this way, the requirements for stopping leakage is reduced. The key problem to be solved is to demonstrate a high $\underline{0}$ value, to develop of negative ion source, a 120,000 to 180,000 gauss leakage blocking magnetic field and a direct energy converter for charged particles.

(2) Mixed reactor with magnetic mirrors. Design research of this type of reactors began relatively early, and reference [13] gave a detailed introduction. We must solve the special problems of the mixed reactor and develop highly efficient direct energy converters.

(3) Creased ring (EBT). The ring-radius ratio is large, the β value is high, and it can naturally control impurities. The key is to demonstrate these advantages, and develop high power microwave heaters (of frequency of about 120 kilo-megahertz and power of about 3 to 6 megawatts).

(4) Reverse Field Packing (RFP). Its polar field approaches the ring field, therefore the β value is high, it has a medium storage requirement (<10 kilo-megajoules), its ring-radius ratio is large, and it does not need auxiliary heating. The problem that has to be solved is to acquire an understanding of the energy loss in the process of establishing the reverse field, to use low frequency feedback stabilization to replace the stabilizing function of the conductor wall; to develop large pulsed superconducting coils, to require the rate of variation of the magnetic field to reach 100,000 gauss/second.

Other reactor designs proposed include straight line packing and fast encasing sleeves. The common characteristics of the above concepts are a high β value, an open geometric shape, the possibility that the needed envelope replacement time is only several days, but some characteristics in plasma physics still need to be demonstrated, and some unique and key technical problems still remain.

There are also some detailed conceptual designs for inertia confinement. The design by LLL takes the energy gain of the laser target $G \approx 700$-1,000, and the efficiency of the laser drive η_L at (2-5) percent. The drive efficiency of the relativity electron beam is high (>25 percent), but $G<50$. Maintenance of the inertia confinement system is good and the requirement for the vacuum system is low. The key is to demonstrate that the gain of the system $\underline{Q} = \eta \times G > 50$, the energy of the drive >1 megajoule, economic production of target pellets, injection and tracking. According to estimates, by 1983, the laser device of SHIVA NOVA will be able to reach $G > 20$ [14].

Some designs have also been made for the non-deuterium-tritium fuel reactor. It does not need tritium as fuel and radioactivity is much smaller. Because the conditions for fusion are sophisticated, they are ideas for the next generation.

Conclusion

Compared to fission reactors, fusion reactors can provide richer and safer energy with less environmental pollution. It can also produce fission fuel more rapidly and in a more versatile way. Because the power density is low, the construction cost of the reactor is higher. Progress in tokamak design research has brought about hope in satisfying the time utilization rate required by power stations, and optimistic estimates of the price of electricity hopefully may compare with that of thermal power stations. Fusion can become a competitive energy but it is estimated that the first commercial demonstration reactor will not be completed by the end of this century.

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(Article received by the Editorial Department in October, 1980)

9296
CSO: 4008/201

BRIEFS

SHANGHAI NUCLEAR MEDICINE--Shanghai, 25 Aug (XINHUA)--More than 40 hospitals here have established departments of nuclear medicine, treating about 100,000 patients a year, according to the Shanghai Municipal Public Health Bureau. Nuclear medicine utilizes radioisotopes to diagnose and treat serious diseases. Shanghai first began to practice nuclear medicine in 1958 and now the therapy is used to diagnose diseases of brain, lungs, thyroid gland, liver and kidneys as well as diseases of heart and bone. Ruijin Hospital, attached to the Shanghai No 2 medical college, has recorded an 85-percent accuracy rate using nuclear medicine to diagnose diseases of the adrenal gland, much higher than that achieved by using traditional blood-testing or x-ray methods. [Beijing XINHUA in English 0701 GMT 25 Aug 82 OW]

CSO: 4008/219

BRIEFS

SCIENCE ABSTRACTS JOURNAL--Beijing, 23 Aug (XINHUA)--The first issue of a new journal CHINESE SCIENCE ABSTRACTS in English, the first of its kind in China, will go on sale at the end of this month, according to the science press. The 48-page monthly edited by the press will have two editions, one covers mathematics, mechanics, physics and technological sciences and the other chemistry, life sciences and earth sciences. A spokesman of the science press said that China is now publishing several hundred periodicals on science and technology. The new journal will help foreign scientists keep in touch with China's work in science and technology and recent scientific results. The journal will be sold both in China and abroad. [Text] [OW251153 Beijing XINHUA in English 0222 GMT 23 Aug 82]

CSO: 4008/215

AUTHOR: LIU Zengwu [0491 2582 2976]
KOU Dianqing [1379 3013 0615]
LYU Gensheng [0712 2704 4141]
WANG Dongqiang [3769 2639 1730]
WEI Peiheng [7614 1014 1854]
WANG Qiping [3769 1142 5493]
DONG Enchang [5576 1869 7022]

ORG: LIU, KOU, LYU, WANG, WEI, WANG of Research Institute of Engineering Dynamics; Chinese Academy of Sciences; DONG of Survey Company, Ministry of Machine Industry No 3

TITLE: "On the Cause of Low Intensity Anomaly in Yutian During the Tangshan Earthquake"

SOURCE: Harbin DIZHEN GONGCHENG YU GONGCHENG ZHENDONG [EARTHQUAKE ENGINEERING AND ENGINEERING VIBRATION] in Chinese No 2, Jun 82 pp 11-25

TEXT OF ENGLISH ABSTRACT: In this paper, the average weighted shear modulus is used as an index for measuring the effect of ground soil in the study of intensity anomaly in Yutian during the 1976 Tangshan earthquake. The cause of low intensity anomaly is primarily correlated to the gound soil with higher average weighted shear modulus (20 m thick) and consisting of high percentage of coarse grain of soil. The effect of the thickness of ground soil on damage is discussed by comparing the average weighted shear modulus of various thickness of ground soil (e.g. 10 m, 20 m, and 30 m) and the damage. In addition, we calculated earthquake response of ground surface at various sites and established the correlation between characteristics of earthquake response and damage. Finally, the reliability of microzoning, using the average weighted shear modulus, is testified by the field data.

AUTHOR: YIN Zhiqian [1438 0037 3383]
LI Chuzhen [2621 2885 2823]
SUN Pingshun [1327 5493 5293]
LI Fucheng [2621 4395 2052]
LI Yubao [2621 3768 1405]

ORG: All of Research Institute of Engineering Dynamics, Chinese Academy of Sciences

TITLE: "Reliability of Earthquake-resistant Structures and Their Deformation Controlled Design"

SOURCE: Harbin DIZHEN GONGCHENG YU GONGCHENG ZHENDONG [EARTHQUAKE ENGINEERING AND ENGINEERING VIBRATION] in Chinese No 2, Jun 82 pp 45-55

TEXT OF ENGLISH ABSTRACT: It is pointed out in this paper that reliability of an earthquake-resistant structure cannot be properly evaluated by using the design method specified in the current seismic code. Elasto-plastic responses to earthquake of 1800 multi-story buildings are culculated from 24 accelerograms and distribution of ductility ratio of such buildings during earthquakes is given. Reliability of a structure is expressed in terms of probability value not exceeding a given bound value of ductility ratio and a design method based on the reliability

[continuation of DIZHEN GONGCHENG YU GONGCHENG ZHENDONG No 2, 1982 pp 45-55]

of structure is proposed. By this method, reliability of a structure can be computed when subjected to different intensities of earthquakes. If occurrence probability of earthquakes of given intensity in a given period is given, the overall reliability of the structure can be obtained. At last, reliability of some of the existing buildings is evaluated by the results in this paper.

6248
CSO: 4009/382

Exchange Conference

AUTHOR: None

ORG: None

TITLE: "Central South Regional Microcomputer Application Experience Exchange Conference"

SOURCE: Zhuzhou SHUKONG JISHU TONGXUN [COMMUNICATION ON NC TECHNIQUE] in Chinese No 3, 5 Aug 82 p 38

ABSTRACT: The Central South Regional Microcomputer Application Experience Exchange Conference, organized and managed by the Central South Regional Electrical Power Transmission Automation Technology Information Network was held on 5-9 May 82 in Luoyang of Henan Province. Aside from members of the information network, 199 delegates representing 120 member units of the Southwest, Northwest, and East China Power Transmission Networks also attended. Among the topics discussed and exchanged at the conference, there were, the application of microcomputer in packaging and sorting machines of postal bureaus, using TRS-80 microcomputer to measure nuclear energy spectrum, microprocessor controlled direct current electrical machine speed regulating system, microprocessor and follower system, computer aided design: computing the internal force of a frame structure, a relatively powerful M6800 microcomputer system, application of Z-80 microcomputer for processing and analysis of electrically measured data of agricultural machines, laser multi-purpose welding machine microcomputer system, use of microcomputer in personnel file management, a simple and practical EPROM programmer, etc. SUN Bolin [1327 2672 2651] of Military Academy of Scientific Research was invited to report on his tour of observing the current condition of automation technology in Japan.

6168
CSO: 4009/388

AUTHOR: CHEN Shaofu [7115 1421 3940]

ORG: Automobile Manufacture Plant No 2

TITLE: "An Example of Designing a Machine Tool Used for Group Technology Machining"

SOURCE: Beijing JICHUANG [MACHINE TOOL] in Chinese No 7, Jul 82 pp 28-30, 45

TEXT OF ENGLISH ABSTRACT: The basic consideration and step of designing a machine tool for group technology machining are realized and explained by an example of designing a program controlled machine tool with alterable transmission gear.

AUTHOR: HONG Shanliang [3163 6365 5328]

ORG: Correspondent of the Journal

TITLE: "High Precision Surface Grinder Model MG-7132"

SOURCE: Beijing JICHUANG [MACHINE TOOL] in Chinese No 7, Jul 82 pp 31-32

TEXT OF ENGLISH ABSTRACT: This article describes the structure characteristics of the main components such as the wheel head, the workable and the column, of the high precision grinder Model MG-7132 made by Hangzhou Machine Tool Plant. The feature of the machine tool is reliable and the operation is convenient. The unparallel accuracy of the ground surface is up to 0.005/1000 mm and the surface finish is ▽11 (> R 0.04 - 0.08 m.)

6248
CSO: 4009/383

AUTHOR: LUO Zhengming [5012 2973 2494]

ORG: Southwest Research Institute of Physics

TITLE: "The Method of the Magnetic Surface Ordinate for Solving the Equilibrium of Plasma Torus With a Non-circular Cross Section"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 4, Jul 82 pp 369-378

TEXT OF ENGLISH ABSTRACT: In this paper, the G.J.W. theory of plasma equilibrium is used for solving the problem of equilibrium of a plasma torus with a non-circular cross section. In the case of quasi-uniform distribution of current density and small distortion of cross section, solutions of third order approximation both inside and outside of the plasma and the current distribution of the maintaining coils have been obtained. It is shown that, the effect due to the deformation of magnetic surface on the displacement of magnetic axis is small, on the other hand because of mode-mode coupling higher harmonic components appear in the external solution of plasma equilibrium. For example, the harmonic components with $m = 4,5$ can be found in the external solution of 3rd order approximation, although the distortion of cross section of plasma contains only components with mode $m = 1,2$ (i.e. elliptical and triangular distortions.)

AUTHOR: ZHU Ruzeng [2612 1172 2582]

ORG: Research Institute of Dynamics, Chinese Academy of Sciences

TITLE: "Simplification of Transport Equations in a Gas Laser With Two Molecular Combined Levels"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 4, Jul 82 pp 379-387

TEXT OF ENGLISH ABSTRACT: For gas lasers with two molecular combined levels (including flowing gas lasers) it is shown that if the diffusion is so fast that the spatial holes burned are washed out, the light intensity superposition principle can be used in the stimulated emission terms and stimulated absorption terms to give a pair of simplified equations. Applying the condition required for spatial holes burned to be washed out given by reference (7) it is shown that generally the light intensity superposition principle can always be used for CW gas lasers. Furthermore, we give the conditions required for the diffusion terms in the first simplified equations to be removed so that another pair of equations can be obtained. It is also pointed out that the diffusion terms in the transport equations can not be neglected if the field strength superposition principle is used.

AUTHOR: ZHONG Zhaoxin [6945 6856 2450]

ORG: China University of Science and Technology

TITLE: "Magnetostatic Equilibrium Configuration of Axisymmetric Magnetic Flux Tube"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 4, Jul 82 pp 404-409

TEXT OF ENGLISH ABSTRACT: In this paper by expansion of physical variables in terms of geometric parameters, the magnetostatic equilibrium configuration of an axisymmetric magnetic flux tube is discussed when the magnetic pressure, thermodynamic pressure, and gravity are taken into account. The magnetic flux tube is divided into a number of local regions and finite local solutions are obtained. Connecting local solutions covering the white region, using boundary condition of the magnetic flux tube and then determining the inner field by means of its connection with the outer field, we can obtain the entire solution of two-dimensional solar magnetic flux tube. On the basis of these solutions we discuss the influence of nonuniform temperature distribution in the magnetic flux tube on magnetic field strength, the magnetic configuration and the effect of twisted field lines when θ_0 is finite. The results are compared with those of reference (1). The results are used to explain magnetic configuration of equilibrium sunspot and energy required for solar flare explosion. The results agree basically with observation.

6248
CSO: 4009/384

AUTHOR: JIANG Zilong [5592 5261 7893]
HU Yuankun [5170 6678 0981]

ORG: None

TITLE: "Vibration of Cylindrical Structures in Nuclear Reactor System Induced by Axial Flow: A State-of-art Review"

SOURCE: Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese No 3, Aug 82 pp 11-18

ABSTRACT: Since the collapse of the Tacoma channel bridge in the USA in 1940, the problem of vibration induced by axial flow has attracted a great deal of attention. This problem exists in suspension bridges, tall and large smokestacks, tall buildings, power transmission structures, submerged telescopes of submarines, etc. and the problem is especially conspicuous in aviation and nuclear power industries as the high strength materials used in airplanes and nuclear reactor systems have made the structures thin and light in weight. Through a review of the conditions of current domestic and foreign research studies on the problem, this paper introduces excitation mechanism, mathematical models, equations demonstrating vibration amplitude, and the method of computing the frequency, discusses the influential factors, and proposes some problems for future research.

AUTHOR: None

ORG: None

TITLE: "The Second National Explosion Mechanics Conference"

SOURCE: Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese No 3, Aug 82 pp 75-76

ABSTRACT: The Second National Explosion Mechanics Conference, under the auspices of the China Society of Mechanics, was held in Yangzhou City in Dec 81. Participants included 260 delegates representing 84 organizations. The major contents of discussion of this conference included the 6 aspects of explosion effect, technique of quantitative measurement of explosion, dynamic characteristics of materials, anti-explosion structures, explosive bombardment, and explosion computation mechanics. Specialists reflected at the conference that there has not been sufficient research on submerged explosion and a great deal of work is still needed to study problems of the effect of faults, transmission of waves in saturated or moist soil, hydrogen bomb equipment, the principle of fragments formation, etc. There has not been sufficient study on charge induced explosions. There is also insufficient coordination between computation work and experimental work; the two are separated in such a manner that the advancement of knowledge of the researchers is affected and the results of their research are unavoidably limited.
6168
CSO: 4009/390

AUTHOR: None

ORG: None

TITLE: "Alloy Steel Conference Held in Beijing"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 7, Jul 82 pp 73-74

ABSTRACT: For the purpose of promoting the development of alloy steel, adjusting the product structure, and orienting the direction of service, the National Planning Committee, Economic Committee, and Science Committee, and the Ministry of Metallurgy called an Alloy Steel Conference in Beijing in the early and middle parts of Apr. More than 220 persons, representing the national departments of planning, economics, finance, and the production, research, and application units of alloy steel and low alloy steel, as well as some specialists attended. The deputy minister of the Ministry of Metallurgy, LU Da [7120 6671] reported the current condition of production of alloy steel and low alloy steel in China and proposed some preliminary plans of development in the 6th 5-year plan. Representatives of several ministries introduced the condition of uses of alloy steel and future needs for its development. Problems of product standards, prices, serialization, and the policy of using alloy elements were discussed as special subjects. Representatives of such industrial departments as machinery, petroleum, light industry, electronics, etc. emphasized the importance of good quality and inexpensive products for establishing the idea of service to the customers

AUTHOR: None

ORG: None

TITLE: "The 4th Standing Council Meeting of the China Society of Metals Was Held"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 7, Jul 82 pp 74-75

ABSTRACT: The 3rd meeting of the 4th Standing Council of the China Society of Metals was held in Beijing, 27-28 Apr 82. Participants included 27 members of the Standing Council. Major contents of the meeting included the following: (1) The work of China Society of Metals in 1981 was summarized; important items of work in 1982 were discussed. At present the Society has about 44,000 members. In 1981, 65 domestic scientific discussion meetings were held and representatives were sent to participate in 25 international meetings. The financial accounts of 1981 and the financial budget of 1982 were approved. (2) The addition of a continuous ingot casting committee was decided upon in order to promote the technique, and production development of ingot casting. It was also decided that there should be no metallurgical documentation filing committee. Instead, the China Archives Society should be asked to establish a branch of metallurgical archives. (3) Suggestions concerning the 4th National Congress of Representatives of the China Society of Metals and the concurrent Scientific Conference were discussed.

AUTHOR: YU Zhaokun [0827 5128 0981]

ORG: None

TITLE: "Scientific Symposium on High Strength Low Alloy Steels"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 7, Jul 82 p 78

ABSTRACT: China Society of Metals Special Steel Committee and the Iron and Steel Company of the Ministry of Metallurgy called a scientific symposium on high strength and low alloy steels in Wugang, 22-26 Dec 81. Previously, symposiums on high strength steel, low temperature steel, atmosphere-resistant and sea-water corrosion tolerant steel, and low alloy corrosion tolerant steel had been convened. Participants of this symposium included 165 persons representing 70 research, production, designing, manufacturing, applications, and eduational institutions; 144 papers were delivered. Among these papers, aspects of materials research, quality improvement, metal phase change mechanism, fracture toughness, brittleness and corrosion mechanism, method of testing, welding, engineering structures were covered. It was pointed out at the symposium that judging from the prospect of development,at present and for a long time to come, of industries, in energy resources, of the sea, of transportation, and construction, a large quantity of low alloy high strength steel will be required. In order to guarantee the safe application of large size welded steel structures manufactured in China, continued research on problems of production, manufacture, and application in the future is urgently needed.

6168
CSO: 4009/385

AUTHOR: None

ORG: None

TITLE: "A Prototype of the SBYB-465K Dual Pump Hydraulic Power Torque Converter Successfully Made"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 24

ABSTRACT: A Fruit of Research Stage Technological Certification Conference was held in Beijing in the middle of June to inspect the prototype of the SBYB-465K dual pump hydraulic power torque converter, which has been the product of joint research of Changsha Mining Research Academy, Shenyang Mining Machinery Plant, and Beijing Industrial College. From 1979 to 1981, the 3 research organizations started the project with nothing but a photograph to produce, finally, this prototype in these 3 short years after overcoming many difficulties. The model machine completed test operations on the 400 kw hydraulic power testing bench for a duration of more than 400 hours and 15,000 data were obtained from the test to prove that the research project of making the instrument has been successful. These data also provide reliable bases for continuous research in the future.

AUTHOR: WANG Feng [3769 1496]
GAO Shunhua [7559 7311 5478]

ORG: None

TITLE: "The DD2056 Single Shaft Vibrating Sifter Certification Conference Held in Kailuan"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 30

ABSTRACT: The DD2056 single shaft vibrating sifter certification conference was held in Fangezhuang Mine of Kailuan Bureau of Mines in the middle of Jun 82. The delegates listened to the reports on its designing, testing, industrial experimentation, and the condition of use by the Luoyang Research Institute of Mining Machines, the Pingdingshan Coal Washing Design Academy, the Huaibei Mining Machine Plant, the Fangezhuang Mine, and the Matou Electrical Plant. The delegates also observed the condition of empty runs and loaded operations of the machine and inspected the technical documentation of the product. They agreed that it is presently China's largest coal grading sifter of high efficiency and simple structure. Its successful research resolved the problem of the urgent needs of grading equipment in China's large and medium coal washing plants. The conference issued a certificate of approval to have it manufactured in batches.

AUTHOR: WU Jianhua [0702 0256 5478]

ORG: None

TITLE: "Chongqing Mining Machinery Plant Successfully Made a New Pneumatic Prop Drawing Winch"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 35

ABSTRACT: In order to meet the needs of the coal industry, the Chongqing Mining Machinery Plant most recently produced the JHF-10 pneumatic prop drawing winch suitable to work under the dangerous condition of coal dust and gas filled pits. It is not operated on electrical power source; therefore, there is no possibility of starting a gas explosion by sparks. It is driven by compressed air instead. It is made of a high strength aluminum alloy and weighs only 80 kg. The sample machine has undergone industrial tests at several pits and won the approval of the users. The certification conference of the winch was held in Chongqing Mining Machinery Plant in the middle of Jun 1982. The delegates of the conference agreed for it to be manufactured in batches.

AUTHOR: LI Heqing [2621 0735 1987]

ORG: None

TITLE: "Trade Quality Inspection of the JD-11.4 Dispatching Winch"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 58

ABSTRACT: During the Huainan Trade Conference in Mar 82, the Mine Pit Hoist and Winch Specialty Group of the Mining Machinery Trade of the Ministry of Machines resolved to carry out a trade quality inspection of the JD011.4 dispatching winches made by the Shanghai Dongfeng Machinery Plant, the Huainan Coal Mine Machinery Plant, and the Xuzhou Mining Equipment Manufacturing Plant. The results of the inspection indicate that the noise and cleanliness levels of the winches of all three plants are lower than the quality regulation requirement. The concrete test results are as follows: The noise of the winch of Shanghai Dongfeng Machinery Plant is 82.25db, thecleanliness 554 mg; the noise of the winch of Huainan Coal Machinery Plant is 76.9 db, and cleanliness is 71.7 mg; the noise of the winch of Xuzhou Mining Equipment Manufacturing Plant is 76 db, the cleanliness 40.1 mg. All major properties are up to the regulation requirements.

6168
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30 September 1982

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DIRECTIONAL FLOW PROBLEM OF SCIENTIFIC, TECHNICAL PERSONNEL DISCUSSED

Beijing GUANGMING RIBAO in Chinese 12 Jul 82 pp 1, 4

[Article by Tao Kai [7118 6963] and Ceng Qing [2582 3237]: "On the Question of Directional Flow of Scientific and Technical Personnel"]

[Text] Abstract

The directional flow of scientific and technical personnel is an urgent problem in today's personnel issue that awaits a solution. Science and technology transfer and most importantly the transfer of scientific and technological capability are generally accompanied by the flow of personnel. To accommodate the needs of the national economic readjustment, personnel should flow from heavy industry to light industry, from publically owned enterprise to collectively owned enterprise, from large cities to medium and small cities, from coastal area to inland and from the urban area to the rural area. The approach taken recently by some medium and small cities of developing science and technology potential by the directional flow of personnel and knowledge has had prominent effects. Personnel recruiting activities conducted by personnel and cadre departments are one form of personnel flow activity. It is a supplement to the current personnel cadre system.

The scope of scientific and technical personnel problem is very wide, it includes such issues as personnel cultivation, utilization and management. These issues in turn are intimately related to the policy on intellectuals, the economic system, the personnel cadre system, science and technology policy, educational system and the party's political and ideological work. We believe that, to solve the personnel problem, the urgent problem today is the directional flow of scientific and technological personnel. This problem arose from the following facts: on the one hand the national economic readjustment and development required vast manpower and the phenomenon of supply not meeting the demand was very serious; on the other hand, the stagnation and waste of personnel is quite prevalent but the potential in personnel is very strong. This contradiction came about because, under the long term influence of the "leftist" thought and the bondage of irrational management system, there was no sensible personnel flow in many departments, prefectures and units.

This has been detrimental to the development of the economy and science and technology and to the growth of personnel. Therefore, in order to vitalize the economy and thoroughly carry out the policy of a coordinated development of the S and T, economy, and society "trinity," we must further purge the "leftist" influence, have an overall and correct understanding of the personnel flow problem, put the policy regarding intellectuals on a even solid basis, improve the personnel cadre management system and carry out a guided and organized directional flow of specialists under the guidance of a universal national plan so that the conflict between personnel shortage and economic and S and T development may be resolved.

Directional Personnel Flow from the Viewpoint of Science and Technology Transfer

Science and technology transfer refers to the trade, transplant, import, promotion and popularization of scientific and technological results, information and capability. The most important aspect is the transfer of scientific and technological capability. Generally speaking the transfer of S and T ability is always accompanied by personnel flow and the relationship between the two is very close.

Scientific and technological transfer may take place via a number of channels, among them, the transfer may be from laboratory to production and application, from military use to civilian use, from advanced regions, departments and industries to backward regions, departments and industries, from cities to rural villages and from overseas to domestic. In order to save space and to illustrate the correlation between science and technology transfer and the flow of S and T personnel more directly, we shall focus our discussion on the transfer from advanced region, department and industries to backward region, departments and industries and from cities to rural areas.

Since the Revolution there have been great developments in China's national economy and science and technology. But due to various reasons, the development was very unbalanced between various departments and industries, between cities and villages and between coastal area and inland areas. Take economy, for example, the per capita value of production in Tianjin is only one half that in Shanghai, and for inland areas the figure is even less than one half that in Tianjin. In the machine building industry, the per capita value of production in Tianjin is only 54 percent of that in Shanghai and that in the inland areas is only 58 percent of that in Tianjin. The unbalanced economic development reflected the great discrepancy existed in S and T development between the advanced departments, industries and regions and the backward departments, industries and regions and this discrepancy has aggrevated the unbalance in economic development. Equally serious irrational situations have also existed in the distribution of S and T personnel. For example, almost two-thirds of the engineering and technical personnel are concentrated in the two departments of machine building and metallurgy and all the engineering and technical personnel in light industries combined is less than 15 percent of the total engineering and technical personnel. (Here light industries refer to all the industries that produce consumer products.) The imbalance in economic and S and T development and the irrational distribution in personnel have a mutual causal relationship and makes personnel flow an objective necessity.

The transfer of scientific and technological capability is essential in the national economic readjustment, in improving economic benefits, in the rationalization of economic structure, in demanding old industries to make technological improvements and in the intellectual renewal of the staff and workers rank; that is to say, the readjustment of the S and T rank and the directional flow of personnel are essential. In order to correct the lack of correlation in the development of capital goods and consumer goods, the irrational distribution of personnel must be systematically changed. It is unimaginable trying to accomplish the tasks of national economic readjustment and technological improvement without science and technology transfer.

China's agriculture production is still in a rather undeveloped state. From 1949 to 1978, heavy industry has grown more than 90 folds, light industry has grown about 20 folds, but agriculture has had only a two fold increase. This situation has greatly affected the national economic development and the improvement of the standard of living of the people. In developing a modernized agriculture production we must take an approach that fully exploits the advantages of traditional Chinese agriculture technology and in the meantime broadly borrows from the results of modern science and technology and the approach must require modest capital investment, consume less energy, and is high in efficiency and favorable to the protection of the ecological environment. The transfer of S and T from cities to countries should include the transfer of S and T capability and S and T personnel. This should not be overlooked.

The unbalanced economic and S and T development in the coastal regions, in the inland regions, in large and medium cities and in remote areas is historical. An important issue in the socialist construction is to gradually reduce this discrepancy. This would be beneficial to the political stability, security in defense and the solidarity and friendship among the various races. To a large extent, the reduction of this discrepancy will rely on the S and T transfer to these areas, including the directional flow of personnel.

To some comrades personnel flow always seems to be a taboo, they seem to view the mere mention of personnel flow as disregarding the organization discipline and obstructing the socialist economic plan and may even be advocating liberalization. Evidently they interpret personnel flow as everybody looking for jobs on their own and disregarding the plan and needs of the state. Aside from the fact that such a phenomenon will not be permitted in our country, this kind of interpretation of personnel flow is partial and superficial. Personnel flow has its definitive scientific meaning, we should try to understand its true meaning; otherwise, a lot of the issues supposedly in the realm of common sense will become hopelessly confusing.

Directional Flow of S and T Personnel Is Feasible

Today the flow of S and T personnel is often accompanied by the transfer of science and technology. Based on the needs of China's national economic readjustment, when science and technology are transferred, the flow of personnel should be from heavy industry to light industry, from publically owned enterprise to collectively owned enterprise, from large cities to medium and

small cities, from the coast to the inland and from urban area to the rural area.

This kind of personnel flow should be conducted in a planned and organized fashion to avoid blindness and anarchy. Of course we are speaking of the overall flow direction and do not preclude personnel flow in the opposite direction due to certain objective needs and subjective reasons. As to the personnel in some remote areas flowing toward the inland, the reasons are complex and specific analyses are required. However, as long as we treasure the personnel and put the policy on solid basis, and maybe adopt some special policy such as attracting large numbers of motivated S and T personnel to construct the frontier with economic incentives and do a good job on the ideological work from a practical viewpoint, the flow direction problem can be solved.

Direction flow of personnel is consistent with the planned economy in socialism, the policy of national economic readjustment and the development plan of science and technology. But what is the probability in realizing such a personnel flow? Based on the current situation in China, we believe it is entirely possible. First, many units today are overstaffed in S and T personnel. These are mostly large research organizations with a high concentration of S and T personnel, institutes of higher learning and industrial enterprises phased out in the readjustment. Secondly the problem of some S and T personnel working on topics not in their specialty is not totally solved. Thirdly, the current structure of the S and T personnel rank is not entirely rational; especially, the "department system" and the "unit system" caused an over supply of technical personnel in some regions, departments and industries and a short supply in others. Fourthly, certain S and T personnel, particularly the medium level and senior level technical people, often have "second specialty" and "third specialty" and have "residual heat" to be tapped after they complete their assigned job. Fifthly, due to historical reasons, the society still has a number of S and T personnel in idle. Besides, a large number of self-taught technical personnel achieving maturity is a force that should not be neglected.

It is fair to say that these are "uncondensed" intellectual resources existing in the society, or, potential strength in S and T. Directional flow of personnel and knowledge may concentrate and develop such potential so that it may make useful contributions to the four modernization. In recent years some medium and small cities have obtained prominent results in developing the S and T potential by directional flow of personnel and know-how. Good results have been obtained in Changzhou and Xuzhou in Jiangsu province, Xiangfan, Yichang and Shashi in Hubei province and in Siping in Jilin province. They first broke down the departmental and industrial boundary on a city wide scale and make uniform rational use of the S and T personnel based on the needs of the national economic readjustment and S and T development and the principle of matching the specialties. They then transferred a group of urgently needed S and T personnel from outside, mostly from personnel congested big cities and units. This is followed by recruiting retired engineering and technical personnel and experienced technicians from outside to teach special knowledge

on a contact basis to solve technical problems. Finally, idling S and T personnel in the society are absorbed. Their initiatives have promoted the transfer of science and technology and economic development. The economic progress made by these cities has attracted national attention.

There is yet another advantage for such practice, namely, it promotes the Party's policy on intellectuals. Under this policy, cases of unfair and false persecutions are reversed and economic and living difficulties of intellectuals are solved. Such a policy is very necessary and there are still a number of urgent problems in this area waiting to be resolved. One thing the intellectuals cannot stand is that their knowledge and know-how cannot play a full role in the socialist construction. Many intellectuals share the same feeling: as long as the party trusts them and relies on them and let them fully develop their specialty and contribute to the people's cause, they would not mind even if they have to live with some hardship. Many S and T personnel held up in big cities felt delighted and enthusiastic about their work after they were transferred to places like Changzhou and Xiangfan and became key member of the technical team. Some of the S and T personnel working in Shanghai, even though their housing problem was solved and even after they had three consecutive pay raises, still wish to leave the big cities and go to some arduous places so that they can do some useful work. The mentality of longing for big cities and easy life does exist among the intellectuals, but only in rare cases. It is incorrect to draw a sweeping conclusion that all the intellectuals in China are stubbornly hankering after big city life.

Recruiting Is One Form of Personnel Flow

S and T personnel flow takes many forms; for example, S and T personnel recruited from outside units on joint appointments or as advisors to provide periodic guidance for local factory and mine enterprises, communes, farms, research organizations and institutes of higher learning; short term academic trips and lectures; technical consulting service on various subjects and academic exchange activities; organizing inter-regional, interdisciplinary and interdepartmental research; and organizing extra-curricular research organizations on a collective ownership basis. All these methods have been found effective. The government has also instituted a number of tentative guidelines in this area.

Of all the different forms of personnel flow, recruiting is considered one of the feasible methods. Based on the experience of some medium and small cities, recruiting may be carried out in the same city such as recruiting and employing idling S and T personnel or self taught talents in the society or it can be aimed at S and T personnel in large cities who meet the urgent local needs and they may be hired with an attractive compensation. Such practice benefits both units and amounts to killing two birds with one stone.

In order to improve the S and T cultural standards of the whole nation, measures must be taken in many other areas concurrent to the development of school education. For remote regions and medium and small cities, practical and feasible economic methods should be taken to recruit engineering and technical

personnel, experience technicians and even research personnel from coastal regions and from medium and large cities (mainly large cities) in order to promote the development of the remote areas and small and medium townships.

Recruiting talents is nothing new. China has practiced recruiting in the early stage of the national construction. For example, in the early 1950's, the department of industry of the then northeast people's government has organized a very large recruiting team and recruited a large number of on-the-job technical personnel and university graduates inside Shanhaiguan and has had a very good effect on the recovery and development of the northest industry. The recruiting under discussion here, just like before, is not recruiting at will; instead, it will be uniformly planned by various local governments and conducted through personnel departments. Although some units advertize in newspapers and on radio broadcasts for information transmission purposes, all the recruited personnel are transferred through the normal personnel procedure after negotiating and obtaining permission from the original unit. It is therefore an organized and guided activity and not a free market for personnel. It does not contradict the current personnel system; instead, it supplements the present personnel system.

Directional flow of personnel is a new issue in the personnel problem we now face. As long as we carry it out in a realistic, organized and planned fashion, it would promote the growth of personnel and the development of S and T and national economy.

9798
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COORDINATED DEVELOPMENT MODEL OF SCIENCE AND TECHNOLOGY, SOCIAL SCIENCES

Beijing RENMIN RIBAO in Chinese 23 Jul 82 p 5

[Article by Zhou Zuhua [6392 4371 5478], Li Xiuguo [2621 4423 2654], Zhou Wenyan [6392 2429 1750], Cao Qingyang [2580 7230 7122] and Yan Zhichao [7051 1807 6389]: "An Enquiry Into a Model For Harmonious Development of Science and Technology and Economic and Social Sciences"]

[Text] The historical trend for contemporary social development is a coordinated development of science and technology and economic and social sciences. In China an issue that requires serious investigation is how to find a specific approach, based on the basic situation in China, to realize a harmonious development of S and T and economic and social sciences.

A review of the progress toward modernization in some developed nations indicates that a universal and imperative model does not exist. The situation of any nation always encompasses merits and shortcomings and advantages and disadvantages. A more successful development strategy is based on the manpower, financial and natural resource conditions and the industrial and agricultural basis, communication and transportation, scientific potential, education level and traditional advantages of a nation. The strategy is to determine the science and technology that the nation under discussion should emphasize and having the potential of success, to establish the complementary industry and to obtain the optimal economic and social benefits. We shall call this approach coordination for advantages.

At the end of the eighteenth century, the capitalistic revolution in Britain swept away the feudal obstacles, led to the development of the capitalistic agriculture and provided great amounts of industrial material. Together with the traditional technological advantages in its textile industry, English products had a wide domestic and overseas market. The industrial revolution in England was therefore led by the technological innovation in textile industry, backed by the development of the engine and quickly formed a series of superior science and technology and industry. It enjoyed enormous economic benefits and occupied the hub of "world factory." Germany did not follow the British approach in its own industrialization. Based on its advantages and unique position and its inventions and innovations in the field of generator, internal combustion engine and organic chemistry, Germany established a series of new industries in electricity, internal combustion engine and chemistry.

This move had allowed Germany to lead the world in S and T and in economic strength during late nineteenth century. Japan has limited land and natural resources but abundant manpower, so it paid special attention to the development of manpower (labor as well as intelligence) and the development of science and technology education. On this basis, Japan selectively imported advanced production technology, modified it and added their own innovation and formed their own S and T and developed a series of superior industries such as automotive, chemical, and steel industries, achieved superiority in international trade and enjoyed sound economic benefits.

The approach taken by Britain, Germany and Japan was not to do many things at once; instead, they formed a series of coordinately developed advantageous technology and industry that suited their national situation which in turn led to the development of other technology and industry and realized the transition from underdevelopment to development. It is fair to say that coordination for advantages is the footing of development strategy for underdeveloped nations.

Coordination for advantage is a complete chain and its center link is the development of advantageous technology. In choosing a development strategy for S and T development, one should naturally take the current overall development characteristics and trend into account and identify the possible breakthrough points and "rich areas" that might bring fruitful results. However, to solve the strategy problem of a nation's S and T development, it is not enough to confine the considerations solely on the S and T system itself. Because of the elevated status and the expanded function, modern science and technology has become an enormous force of promotion for economic and social development. Its direction, scope and speed of development are constrained by the needs of social development and the conditions it provides. Therefore, the discussion of S and T development strategy cannot be confined only to science and technology but should be investigated in terms of the needs and potentials in science and technology, and economic and social sciences. To develop an advantageous S and T, coordination and overall arrangement must be carried out for S and T and economic and social sciences.

Based on the above viewpoint and the basic situation in China, we believe that we should start from our resources and other conditions, select a series of industry and associated S and T for priority development and for an advantageous industry and technology that is characteristic of the Chinese situation.

China has many superior mineral resources. For example, China has the world's largest resources of tungsten, antimony, and rare earth elements. Reserves of tin, lead, zinc, nickel, aluminum, molybdenum, vanadium and titanium are also among the highest in the world. Nonferrous metals are a great advantageous resource in China. Because they are indispensible in defense, industry, pioneering science and technology, and the livelihood of the population and there is a great demand on them both domestic and foreign, the market is very wide. For this reason, a series of advantageous industries should be formed. The crucial link between favorable mineral resources and favorable industry is a superior S and T, which is precisely our weak link. We can no longer stay at the level of exporting ore for foreign exchange. We should establish an

advantageous industry of nonferrous metals. The crucial step is the reinforcement of S and T research and development and the establishment of a continuous chain from prospecting, mining, dressing, refining, extensive processing to product manufacturing based on new technology, method, equipment, procedure and product variety. Only then can the advantageous resources be fully developed and utilized and the advantageous industry can then be established and the products will have an edge on the market. The development and utilization of coal and petroleum resources should be handled in a similar fashion.

China has many unique economically advantageous regions. For example, Hainan Dao, located in the tropical and subtropical zone, is suited for planting many tropical crops of high economic value and has many precious botanical specimens and rare animals. It is also rich in grass land and aquatic resources and has unique natural conditions and outstanding advantages. But, due to a number of reasons, these advantages are not only undeveloped, there may even be a possibility of gradually losing them. To develop this wonderful island and make it an industrial crop zone, we must develop the associated science and technology, in addition to having a correct policy. As long as we coordinate the harmonious development of S and T and economic and social sciences according to the needs of the development task, the day will come when this island will have great prosperity.

China also has some historical and traditional advantages. For example, the silk of Suzhou and Hangzhou, the china of Jindezhen, Chinese herb medicine all over the country, handicrafts of various places, the world famous Chinese food, superior ancient culture and famous scenic spots and places of historical interest. All these are unique creations of the Chinese people and have an international reputation. But, in today's rapid progress of S and T, if we were to stick to the established practice and not using modern technology to change the technical basis and add luster to the traditional advantages, the development of traditional advantages will be greatly limited and we may even lose some of the traditional advantages. We must strengthen the effort of scientific research and technical development in these areas so that the traditional advantages may ascend to a new level and we may continue to maintain our advantages. Development in this area may form a unique industry that combine S and T and arts. It may mold the results of modern S and T and the wisdom of the Chinese nation, absorb a great labor force with modest investment and produce good economic and social benefits.

On the whole, the culture, education and S and T in China are relatively underdeveloped, but there are advanced regions centered around big cities that have their own advantages. We should make full use of the abundant talents, rich information and literature, sophisticated equipments and facility and the strong problem-solving ability of these areas and develop some technology-intensive industries centered around research units and universities to produce competitive products to play a leading role in China and to strive for an advantageous position on the world market.

Of course our advantages are not limited to the ones mentioned here and there are more industries and technologies that we should develop. We have merely enumerated some examples. The basic idea is that we should develop all the potential advantages, enhance the existing advantages, actively create future advantages, develop a variety of advantageous science and technology, establish various advantageous industries and seek the optimum economic and social benefits.

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SEOUL PAPER DISCUSSES CHINA'S NUCLEAR ENERGY PLAN

Seoul WONCHARYOK SANOP in Korean No 5 May-Jun 82 pp 52-54

[Article: "Communist China's Nuclear Power Plan"]

[Text] The Southweat Research Institute (SWRI) is a secret nuclear research center located near Chengdu, deep in China's heartland.

Until quite recently SWRI was closed to all foreigners, but in early November last year a visit to the center and observation of the new 125 MWT High-flux Engineering Test Reactor (HFETR) which began full capacity operation on 16 December 1980 were permitted.

SWRI belongs to the Second Machine Industries Ministry which is responsible for Communist China's military and civilian nuclear planning.

The construction of this research center began in 1960, but construction progress was delayed until 1977 due to the Cultural Revolution.

HFETR was required to be completely planned, designed, and built to go into operation solely by the Communist Chinese without any external help.

SWRI's main goals are as follows: research on 3 percent low enrichment nuclear fuel and 90 percent high enrichment nuclear fuel; HFETR operations; research on reactor physics, thermo- and hydro-dynamics, reactor structural dynamics, welding technology, radiation barriers, and loss-of-collant accidents (LOCA); design of the Communist Chinese standard 600 MWEPWR which can be built with Chinese technology; research on hydrochemistry, radiation chemistry, and analytical chemistry; continuing improvement of the capabilities of the SWRI computers. In the computer research office there are two kinds of the latest computers, the model DJS-6 and the model TQ-6.

The Shanghai research center, which is one of the research centers belonging to Communist China's Academy of Sciences, is designing a 300 MWe PWR plant and is said to have a rough actual-size model. The SWRI is designing the newest standard 600 MWe PWR and is also studying the design of a high speed reactor. Also, the reconstruction of the heavy water research reactor (HWRR-1) at a nuclear power research center near Beijing is quite important. The reconstruction began in January 1979 and by October 1980 the reactor had

recovered full capacity. The reconstructed HWRR-1 was increased from 10MWt to 15MWt and the maximum thermal neutron flux also has increased about 20 percent. The new design is said to be able to produce three to five times as many radioactive isotopes as before.

The HFETR uses multi-rod nuclear fuel elements of 30 percent enriched uranium, and is a pressure container style reactor using light water as its decelerant and coolant and beryllium as its reflector. Its generating capacity is 125 MW, and the maximum thermal neutron flux (0.6MeV) is 6.2 x $10^{14}n/cm^2sec$. This reactor was designed primarily for research in the radioactivity of the materials and fuels of power reactors. It is equipped with a sodium loop in order to study high speed reactor physics. Also, the reactor core was designed considering experiments in the hot gas cooling reactor category. The test reactor previously built in Communist China had maximum radiation channels of 110 mm in diameter; by comparison, the maximum radiation channels in this new reactor are 230 mm in diameter and the diameter of most channels is 150 mm.

In order to develop research into the activity of irradiated fuels, a series of high level hot cell and radio-chemistry laboratories are attached to the reactor; also the reactor is designed to produce highly radioactive cobalt for medical use and has equipment that can do neutron radiation analysis. Also, the equipment can irradiate transplutonium elements.

It appears that the Communist Chinese State Science & Technology Commission regulates and controls the production of radioactive isotopes at this new type reactor. Among its various research institutes in Beijing, this committee has a radiation center that studies irradiated foodstuffs. The current capabilities of this center are somewhat limited and the cobalt used in its current facilities is brought in from Canada.

On 19 October 1981, Vice-premier Yu Qiuli stated that Communist China must continue to emphasize the development of domestic coal and hydropower resources while exploring the potential of oil, natural gas, nuclear power and alternate energy. Also, regarding nuclear power he emphasized the time to push by stages research, design, and construction of nuclear power plants, seen as important energy sources, and in preparation for future development he urged that Communist China begin medium and small-scale nuclear power plants as electricity generating projects to build experience, gain skill, and train manpower.

The State Energy Advisory Committee is composed of 52 specialists in coal, mining, electricity generation, petroleum, and nuclear power. This committee is responsible for policies and measures for the development and use, and conservation of energy resources and also investigates the feasibility of joint projects, including foreign funds. This committee has five sub-committees for coal, oil, electricity, nuclear power and new energy sources.

Also, the State Scientific and Technological Commission has an independent nuclear power committee; this committee is composed of 38 nuclear power specialists and science administrators, and is made up of small committees for handling various problems such as nuclear fuel, equipment, safety and defense, manpower training and utilization, introduction of technology, and the dissemination of research results.

Computer capabilities: according to Communist China's 1981-82 annal, Communist China has 3,000 large, medium, and small general digital computers and over 500 computer centers throughout the country. The training of qualified manpower remains an important task in the computer sicence field.

The role of the Academy of Sciences: The Academy of Sciences controls over 131 research institutes and has a staff of over 100,000, including about 7,000 scientists. Also, the Academy of Sciences occasionally takes over research institutes to supervise the scientists' research.

The Guangzhou Project: Negotiations are continuing between Communist China and Hong Kong to build two 900MWe nuclear power plants near Guangzhou. The State Council, composed of 15 vice-premiers, has not yet given authorization for this project. Although Framatome, Westinghouse, Combustion Engineering and Great Britain are negotiating with the Communist Chinese authorities, Quadrex Inc. is Communist China's consultant on this project. Communist China is hoping to complete this project before 1990.

Prospects for hydro-electricity: Communist China relies heavily on water power in its future energy resource planning.

However, the planning is criticized for not being sufficiently aware of the amount of arable land that will be flooded with the completing of dams when it considered potential water power storage capacity. In relation to this, the peasants are an important element in the resolution of this problem. The peasants and the state are saying that they must not lose most of the cropland that would be flooded and unable to produce crops. Thus the water power storage capacity is being re-evaluated and decreased for the most part.

Coal: Communist China has huge coal reserves estimated at 640 billion tons, but its ability to continuously increase coal production has lessened greatly in the past 2 years. Mining cannot keep up with the increasing energy demand.

Communist China's cities are severely polluted with ash and suspended particles from coal. Medical costs for respiratory diseases are high and are reported to be gradually going higher.

Communist China's big problem is a very large population and a relatively limited amount of fertile farmland; also, it is faced with the difficulty of an energy demand that will multiply over the next 20-50 years. As many other countries have already realized, Communist China's policy-makers have also begun to realize that if they are to secure sufficient energy to develop their economy and maintain peace and security they must not rely on coal and water power alone, but must find and develop nuclear power and other energy sources.

Discussions are taking shape for the development of nuclear power generation in Communist China. In December 1981 the People's Congress' Proposal Committee recommended to the State Council that nuclear power generation be developed.

On the surface, the plan to develop a total Sinified nuclear power generation plan calls for 300 MWe and 600 MWe PWR's, but Communist China is said to have plans to purchase 2-6 1,000 MWe class plants in the next 10 years.

The cost needed for each plant is estimated at $250 million. That is, $100 million for NSSS, $100 million for the turbine systems, and $50 million for A/E and other uses. Communist China wants a rapid increase in electric power production, and nuclear power plays an important part in this plan. Communist China appears to believe that it can buy a number of $250 million plants if the plan to introduce nuclear power development receives State Council approval.

7139
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INTERACTION BETWEEN INTENSIVE RELATIVISTIC ELECTRON BEAM, TARGET ANALYZED

Leshan HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese No 2, 1981 pp 82-86

[Article by Xu Fuyuan [1776 4395 0337], Institute of Atomic Energy, Chinese Academy of Sciences: "Interaction Between an Intense Relativistic Electron Beam and Target Material"]

[Excerpt] 1. Experimental Conditions and Results

The experiment described by S. Nakai [3] et al. had the following conditions and results.

Accelerator (Reiden III) experimental parameters: $V = 2 \cdot 10^5$ volts; $I = 4 \cdot 10^4$ amperes; $\tau = 8 \cdot 10^{-8}$seconds. Target parameters: deuterated polyethylene (CD_2) target; radius $r = 0.075$ cm; initial density $\rho_0 = 1.06$ g/cm^3.

Experimental results: average plasma temperature $T_p = T_e = T_i \approx 1.5$ keV. For 1 gram-molecule of CD_2, when the temperature reached 1.5 keV, the C and D atoms were entirely ionized, and the following figures were obtained: C ion density $n_i^C = 4 \cdot 10^{22}$ cm^{-3}; D ion density $n_i^D = 8 \cdot 10^{22}$ cm^{-3}; electron density $n_e = 3.2 \cdot 10^{23}$ cm^{-3}; plasma density $n_p = 4.4 \cdot 10^{23}$ cm^{-3}; plasma oscillation frequency $\omega_p \approx \omega_e = \left(\frac{4\pi n_e e^2}{m_e}\right)^{1/2} = 3.18 \cdot 10^{16}$ radians/sec; electron rest energy $\varepsilon_0 = m_e c^2 = 0.511 \cdot 10^6$ eV; relativistic electron kinetic motion $\varepsilon_k = 2 \cdot 10^5$ eV; total energy of relativistic electron $\varepsilon = \varepsilon_0 + \varepsilon_k = 0.711 \cdot 10^6$ eV; relativistic electron velocity parameter $\beta = \sqrt{1-(\varepsilon_0/\varepsilon)^2} = 0.693$; relativistic electron velocity parameter $v_b = \beta c = 2.08 \cdot 10^{10}$ cm/sec; density of relativistic electron beam $n_b = I_b/ev_b\pi r^2 = 6.74 \cdot 10^{14}$ cm^{-3}.

Using an approximative energy balance equation, the experimental data can be used to find the range of the electron beam in the CD_2:

$$\lambda \approx \frac{VI\tau}{n_p k \bar{T}_v \pi r^2} = 3.44 \times 10^{-4} \text{ cm} \qquad (1)$$

2. The Range as Given by the Classical Theory

Here the electron beam is treated as consisting of point charges which are incident on a plasma with an oscillation frequency ω_p, giving an average energy loss [4] of

$$-\overline{\frac{dE}{dx}} = \frac{e^2\omega_p^2}{v_b^2}\ln\left(\frac{v_b k_m}{\omega_p}\right). \tag{2}$$

where k_m is the greatest wave vector of the collective mode of the plasma, defined as follows:

$$k_m = \alpha m_e v_b^2/e^2 \ \text{cm}^{-1}.$$

Here $\alpha = 1.123$ is a constant. From Eq. 2 we can find the range of the electron beam:

$$R=\int_0^{E_0}\frac{dE}{-(\overline{dE}/dx)}=\frac{1}{e^2\omega_p^2}\int_0^{E_0}\frac{v_b^2 dE}{\ln(\alpha v_b^3 m_e/e^2\omega_p)} \tag{3}$$

where $E_0 = 0.2$ GeV is the initial energy of the beam electrons; by numerical integration we find for the range

$$R = 0.034479 \text{ cm}.$$

3. Computation of the Range Using Two-Beam Instability Theory

When an electron beam is incident on a plasma provided that the electromagnetic skin depth (c/ω_p) is much smaller than the beam radius, an electric countercurrent will be produced in the plasma. The interaction between the electrons making up this countercurrent and the electrons or ions in the plasma produces two-beam instability. The electron beam incident on the target is relativistic ($v_b \approx c$), but the electron beam induced in the countercurrent is in fact nonrelativistic, because $n_b \ll n_e$, and since $I_b = -I_e$, then $|v_e| = |-n_b v_b/n_e| \ll c$, which is to say that the velocity of the electrons in the countercurrent is much slower than the speed of light. Thus it is apparent that, in dealing with the interaction between a strong relativistic electron beam and the target material, we may use the cold plasma approximation by treating the countercurrent electron beam and the newly-ionized target plasma (low-temperature corona plasma) as cold beams. Using the equation of continuity, the momentum equation and the Poisson equation, we can find the electron-electron and electron-ion two-beam instability dispersion relationship and rate of growth (here we use the cold plasma approximation):

equation of continuity
$$\frac{\partial n_j}{\partial t}+\frac{\partial}{\partial x}(n_j v_j)=0, \tag{4}$$

momentum equation
$$m_j\left(\frac{\partial v_j}{\partial t}+v_j\frac{\partial v_j}{\partial x}\right)=-e_j\frac{\partial\phi}{\partial x}, \tag{5}$$

Poisson equation
$$\frac{\partial^2\phi}{\partial x^2}=-4\pi e(n_j-n_j'). \tag{6}$$

We take the perturbation to have the following plane-wave form:

$$q = q_0 \exp\{i(k\cdot r - \omega t)\}. \tag{7}$$

where $\omega = \omega_r + i\gamma$, with γ denoting the growth rate. Substituting Eq. 7 into Eqs. 4-6 we obtain:

for electron-electron two-beam instability,

the dispersion relation $$1-\omega_p^2/\omega^2-\omega_b^2/(\omega-kv_e)^2=0, \tag{8}$$

the maximum linear growth rate $$\gamma_m=\sqrt{3}/2^{4/3}\cdot(n_b/n_e)^{1/3}\omega_p. \tag{9}$$

for electron-ion two-beam instability,

the dispersion relation $$1-\frac{\omega_i^2/Z^*}{(\omega-kv_i)^2}-\frac{\omega_b^2}{(\omega-kv_e)^2}=0, \tag{10}$$

the maximum linear growth rate $$\gamma_m=\frac{\sqrt{3}}{2^{4/3}}(n_b/n_i)^{1/3}\frac{\omega_i}{\sqrt{Z^*}}. \tag{11}$$

where Z^* is the effective charge number for the ions. Because $\omega_p >> \omega_i/\sqrt{Z^*}$, we may take into account only electron-electron two-beam instability.

From Eq. 9 we obtain

$$\gamma_m = 2.81 \cdot 10^{13}\ \text{sec}^{-1}, \tag{12}$$

from which we obtain the maximum range of the electron beam in the target material:

$$R = v_b/\gamma_m = 7.4 \cdot 10^{-4}\ \text{cm}. \tag{13}$$

The theoretical value obtained above and the experimental values are presented in Table 1.

Table 1. Theoretical and Experimental Values for Range

	Experimental value	Classical plasma theory	Two-beam instability theory
Range, cm	$3.44 \cdot 10^{-4}$	$3.4479 \cdot 10^{-2}$	$7.4 \cdot 10^{-4}$

Table 1a. Values of I and X

I, amperes	$5 \cdot 10^4$	$1 \cdot 10^5$	$1.5 \cdot 10^5$	$2.5 \cdot 10^5$	$6 \cdot 10^5$
X	1	2.15	3.26	5.0	12.6

It is apparent from Table 1 that the range obtained by the classical theory is two orders of magnitude larger than the experimental figure, while the two-beam instability theory gives a value about twice as large as the experimental figure; if we take account of the magnetic enhancement effect, the theoretical range can be decreased still further.

4. The Magnetic Enhancement Effect

When the electron beam current is sufficiently great (greater than about $5 \cdot 10^4$ A), the effect of the strong magnetic field produced by the beam on the beam itself causes the beam electrons to enter the target plasma on a spiral path. This is equivalent to an increase in the electron density, and it increases the interaction between the electron beam and the target plasma.

The magnetic enhancement effect was discovered by Yonas et al. [5] in 1974. Clauser et al. [6] showed experimentally in 1977 that the magnetic enhancement was 5 times greater in a thin target than in a thick target. Yonas gave the magnetic enhancement effect as a function of beam current intensity [7]; the experimental curve yields the data given in Fig. 1a. Here χ is the magnetic enhancement factor for the deposition power, $\chi = P_{enh}/P_{non}$, where P_{enh} and P_{non} are the deposition powers with and without magnetic enhancement.

The magnetic field created by the electron beam is perpendicular to the direction of the beam, and according to theoretical analysis the magnetic enhancement effect should be proportional to the rotational frequency of the beam as it enters the target plasma,

$$\chi = k\omega_{ce}. \tag{14}$$

where k is a proportionality factor. The frequency of rotation of an electron in a magnetic field B (in gauss) is

$$\omega_{ce} = eB/m_e c = 1.76 \cdot 10^7 \quad B \text{ radians/sec.} \tag{15}$$

If the electron beam is considered to be a straight-line current and the beam radius is 1 mm, the magnetic field produced by the beam has the strength

$$B = \frac{\mu_0}{2\pi} \frac{I}{r} = 2I \text{ gauss} \tag{16}$$

The values of B, ω_{ce} and k found from Eqs. 14 through 16 are presented in Table 2.

Table 2. Values of B, ω_{ce} and k

Beam current I, amperes	$5 \cdot 10^4$	$1 \cdot 10^5$	$1.5 \cdot 10^5$	$2.5 \cdot 10^5$	$6 \cdot 10^5$
B, gauss	$1 \cdot 10^5$	$2 \cdot 10^5$	$3 \cdot 10^5$	$5 \cdot 10^5$	$1.2 \cdot 10^6$
ω_{ce}, radians/sec	$1.76 \cdot 10^{12}$	$3.52 \cdot 10^{12}$	$5.28 \cdot 10^{12}$	$8.8 \cdot 10^{12}$	$2.11 \cdot 10^{13}$
$k = \chi_{exp}/\omega_{ce}$	$0.568 \cdot 10^{-12}$	$0.61 \cdot 10^{-12}$	$0.617 \cdot 10^{-12}$	$0.568 \cdot 10^{-12}$	$0.597 \cdot 10^{-12}$

It is evident from Table 2 that k is almost independent of the current and is approximately constant, and accordingly we use the average value of $0.592 \cdot 10^{12}$. Thus we can determine χ_{theor} and P^{enh}_{theor} from the following equations:

$$\chi_{theor} = \bar{k}\omega_{ce}, \tag{17}$$

$$P^{enh}_{theor} = \chi_{theor} P^{non}_{exp} \tag{18}$$

The values of χ_{theor} P_{theor} obtained from Eqs. 17 and 18 and the corresponding experimental values are presented in Table 3.

Table 3. χ_{theor}, P_{theor} and Corresponding Experimental Values

Beam current I, amperes	$5 \cdot 10^4$	$1 \cdot 10^5$	$1.5 \cdot 10^5$	$2.5 \cdot 10^5$	$6 \cdot 10^5$
χ_{exp}	1	2.15	3.26	5.0	12.6
χ_{theor}	1.04	2.08	3.13	5.22	12.5
P^{enh}_{exp}, 10^{-12}W/G	6	27	62	150	900
P^{enh}_{theor}, 10^{12} W/g	6.24	26.9	59.1	156	930

It can be seen from Tables 2 and 3 that there is good agreement between χ_{theor} and χ_{exp} and between P_{theor} and P_{exp}, with an error not exceeding 4 percent.

Fig. 1 presents curves for P_{theor} and P_{exp}.

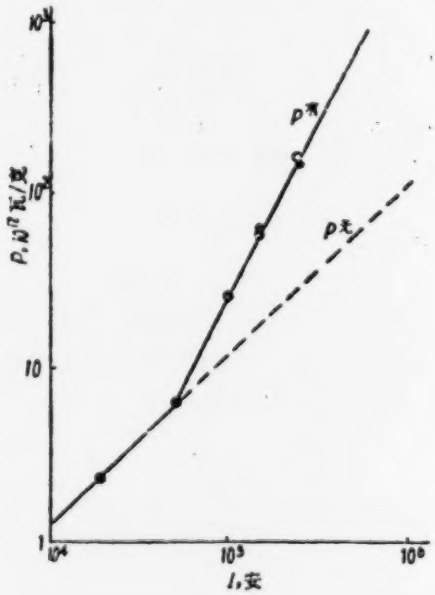

Fig. 2. Deposition Power as a Function of Current

•--experimental values; o--theoretical values; P^{enh}--deposition power with magnetic enhancement; P^{non}--deposition power without magnetic enhancement.

5. Discussion

With regard to the mechanism of interaction between an intense relativistic electron beam and the target material, American investigators believe that the magnetic enhancement effect has the primary role [5-7], while Japanese investigators believe that the primary role is played by the two-beam instability effect [3] in the plasma. On the basis of the theoretical calculations presented here, the present author concludes that taking account of both magnetic enhancement and two-beam instability, which are abnormal absorption effects, gives a very good explanation of the experimental results in the entire beam current region. When the beam current exceeds $5 \cdot 10^4$ A, the magnetic enhancement effect will play the primary role, and when the current is less than $5 \cdot 10^4$ A, two-beam instability plays the primary role. In an intense beam current, the classical absorption mechanism alone cannot explain the experimental results. In addition it should be pointed out that the experiments on the interaction between an intense relativistic electron beam and the target material are still not systematic in character, and more systematic experimental and theoretical investigation should be conducted in order to clarify the question whether or not an intense relativistic electron beam can produce fusion.

During the completion of this article, Professors Wang Ganchang [3769 3227 249] and Yu Min [0060 2404] and Assistant Professor Chen Jia'er [7115 0163 3167] provided assistance; when English beam physics expert Dr J. D. Lawson visited China he discussed the article with the author and made valuable comments. The author takes this occasion to express his thanks.

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8480
CSO: 8011/1561

CONSTRUCTION OF UNDERGROUND SHELTERS DISCUSSED

Changing DAXIA GONGCHENG [UNDERGROUND ENGINEERING] in Chinese No 6, 1982 pp 36-39

[Article by Xianyu Fankang, [7639 0600 2455 1660]: "Combine the Construction of Civilian Buildings With that of Underground Air Defense Shelters"]

[Text] Underground air defense shelters are an important component part of civil air defense engineering construction and also a reliable foundation for aboveground buildings. During war time, the combined construction of civilian buildings and underground air defense shelters solves the problems of sheltering people and maintaining positions for city fighting. During peacetime, they can be used for commercial services. This wartime and peacetime combination usage will bring about beneficial investment results. Therefore, during the period of national economic adjustment, various individual views have been put forward on how best to construct underground air defense shelters.

Major Existing Problems

Following the development of urban construction and the requirements of war preparedness, each major city in China has partially constructed underground air defense shelters; great successes have been achieved. However, because of insufficient knowledge and experience, stress on square meters and neglect of engineering quality, there has been a lack of unified planning, design, construction, checking and acceptance. After a construction unit receives its subsidy, frequently it first maintains the ground above and does not concern itself with the underground area. As a result, underground air defense shelters have a lot of dripping water, a great deal of accumulated water and many "halfway" constructions. Some regions are not very strict about design examination and approval procedures, so that the earthen ceiling of the underground air defense shelter is very thin; the layout of the opening's "three defenses" room is not rational; the ventilation and lighting window is open too far, the strength around the window opening is not substantial, and there are no protective measures. The conditions of some underground air defense shelters are very good, but the units in the area do not use, safeguard or manage them. At present, some units are disseminating the falsehood that "the underground air defense shelters were not handled well." Some important cities have not given proper

consideration to the construction of underground air defense shelters in the new construction of many large area high-rise buildings. In several places, when reconstructing buildings and extending roads, the underground air defense shelters have been filled in without authorization and the waste is startling.

Special Features of Underground Air Defense Shelters

Based on domestic and foreign nuclear effects test materials and the verificationof over 10 years' experience, underground air defense shelters have the following special features:

1. The mutual strengthening of above- and below-ground buildings. The simultaneous construction of underground air defense shelters and aboveground buildings is advantageous to strengthening the foundation and the antiseismic capabilities of the aboveground building. After an earthquake, if an underground air defense shelter has been constructed in the middle section of a five-story building, the two ends of this building will have completely collapsed and only the middle section will remain. A building over an underground air defense shelter can lessen the shock wave of a nuclear explosion; compared to dugout, open type defense works, the excessive pressure of the shock wave on the ceiling of the underground air defense shelter can be lessened by 5 percent. A building over an underground air defense shelter is also advantageous for lessening nuclear radiation. Compared to simply constructed defense works, the covering earth of the underground air defense shelter can be one-third to one-sixth thinner. The construction of a sturdy high-rise building over an underground air defense shelter can advance the explosion of a common explosive bomb. This can reduce the bomb's shock and destructive effects on the underground air defense shelter.

2. When the construction of above- and below-ground buildings is combined, the sheltering of people during war time is convenient and during peacetime it is easy to utilize. All underground air defense shelters have entrances and exits. During war time, after an alarm is sounded, people can go underground in only about 6 minutes. In peacetime, entry and departure are also convenient. The commercial network of the combined ground buildings makes it easy to realize underground services for both peacetime and wartime usage. For example, among the underground air defense shelters of a certain city, 37.28 percent of them maintain and use combined above- and below-ground facilities for underground photography, hairdressing, cold and hot drinks, shops, hotels, conference rooms, cultural recreation rooms, daily reparis, etc. There is no noise or waste gas, they provide increased economic income, and they resolve the problem of finding employment for school graduates. Therefore, these networks are warmly welcomed by the masses.

3. The construction of underground air defense shelters not only uses city land for building, but under the premise of guaranteeing quality they can save materials and lower building costs. For example, a certain building's underground air defense shelter in Wuhan has a total area of 1,977 square meters. During wartime, it can shelter people and during peacetime it is a

laboratory with a total building cost of 722,400 yuan. This lowered the foundation cost of the aboveground building by 222,400 yuan, and the building of the laboratory underground used 1,831 square meters less ground at a savings os 293,000 yuan. In this way, the civil air defense only required an investment of 207,000 yuan, and the unit cost was actually 105 yuan per square meter. We can see from this that the combined construction of civilian buildings and underground air defense shelters is very economical for both peacetime and wartime utilization. A steel reinforced concrete prefabricated cast-in-place layered slab is used for the ceiling of the underground air defense shelter. For example, a 10,000 square meter underground air defense shelter can save over 150 cubic meters of wood.

4. It is easy to guarantee quality when building underground air defense shelters. A blueprint of an underground air defense shelter is made by a design institute according to a "standard" uniform design. After the blueprint is standarized, examined and approved by both the consturction committee and civil defense, construction begins. A team of specialists and builders is in charge. Based on the design blueprints and technical operations rules, when construction is completed nothing is left behind. After completion, it is jointly checked and accepted, the quality level is appraised and the accounts are settled for the building file. When done in this way, it is possible to build a shelter to completion.

5. According to foreign materials, Switzerland, celebrated for its "permanent neutrality," has a 47-year history of building civil defense works, beginning in 1934. All the high-rise buildings constructed in that country must have one- to three-story underground air defense shelters, and when private houses are rebuilt, the building of an underground air defense shelter is mandatory. The state subsidizes two-thirds of the cost, while the individual pays one-third. Eighty percent of the present Swiss civil defense works consist of underground air defense shelters for both peacetime and wartime use. In the last 10 years, all newly constructed buildings in Sweden have underground air defense shelters. In Sweden it is a government regulation that when a new building is constructed, 20 percent of the total building cost must go to building an underground air defense shelter.

There are four types of defense works in civil air defense engineering construction. The resistance power of underground air defense shelters is higher than that of simply constructed dugout defense works, and their construction costs are lower than defense works with similar structural forms. When quality is the primary factor, the policy of combining peacetime and wartime usage is easily realized in building underground air defense shelters. Therefore, aside from planning to improve the maintenance of underground air defense shelters year after year for cities, which will be greatly affected by a war situation, it is also necessary to concentrate financial and material resources in low-lying regions with dense populations and little open space. When it is necessary to make a deep foundation or newly construct a high-rise building, it should be arranged beforehand that underground air defense shelters with peacetime and wartime uses are constructed with them. As far as possible, the digging of tunnels under already constructed high-rise buildings when war appears imminent should be avoided, as this is not economical or safe.

Technical Problems in Constructing Underground Air Defense Shelters

1. The thickness of the covering soil should satisfy the requirements to guard against early nuclear radiation. If the reinforced concrete ceiling of the underground air defense shelter is 25 centimeters, the theoretical calculations are that when the conversion calls for soil of 35 centimeters the covering soil on the defense work only requires a thickness of 30 centimeters. Yet, during war, a surprise attack of enemy bombs or nuclear weapons will necessarily cause large fires in a city. This will create a long-lasting high-temperature layer on top of the underground air defense shelter, and as a result it is necessary to have a covering layer of a certain thickness over the underground air defense shelter for heat insulation. Thus, it is necessary that the thickness of the covering soil be no less than 50 centimeters.

2. The structure of the layered slab. The steel reinforced prefabricated cast-in-place layered slab has relatively good ability to prevent moving loads. The prefabricated part of the layered slab should be solid, as an empty slab is useless. The extending slab end of the main reinforcement in the slab should not be smaller than 60 millimeters. To guarantee the integration of the prefabrication and casting-in-place, notches should be made on the upper surface one-third of the way from the end of each prefabricated slab (see Figure 1). Prior to beginning construction, the slab should be washed clean, one layer brushed with similar grade cement, then it should be poured and pounded solid.

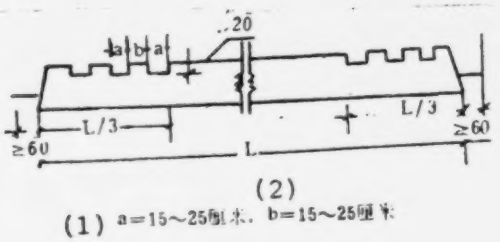

Figure 1.

Key: 1. a=15-25 centimeters
2. b=15-25 centimeters

3. Open ventilation lighting window. To resolve the problem of natural ventilation and lighting, based on requirements, an underground air defense shelter can have the ventilation lighting window on the outer wall open. However, the width of the window opening should be no greater than one-third the open space measurement of the underground air defense shelter; it should not be larger than 1.2 meters. The periphery of the window opening is strengthened with steel reinforced concrete according to "standard" requirements. The window opening's safe guarding door (shield plate) or steel-reinforced concrete prefabricated beam is closed or fitted during wartime, and then the covering soil is sealed. At the same time, consideration should be given to preventing surface water from pouring in and rain water from seeping into the defense work (see Figure2).

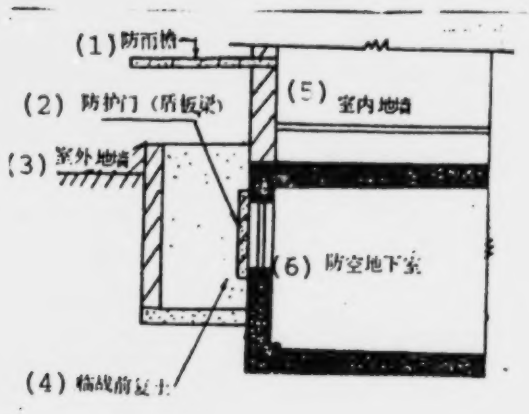

Figure 2

Key:
1. Rain guard eave
2. Protective door (shield plate beam)
3. Earthen wall outside the shelter
4. Covering soil put in place just before war
5. Earthen wall inside the shelter
6. Underground air defense shelter

4. The layout of the open section's "three preventions" room should be compact and rational. Generally, the washroom and superpressure exhaust equipment should be installed in the main exit-entrance opening (see Figure 3).

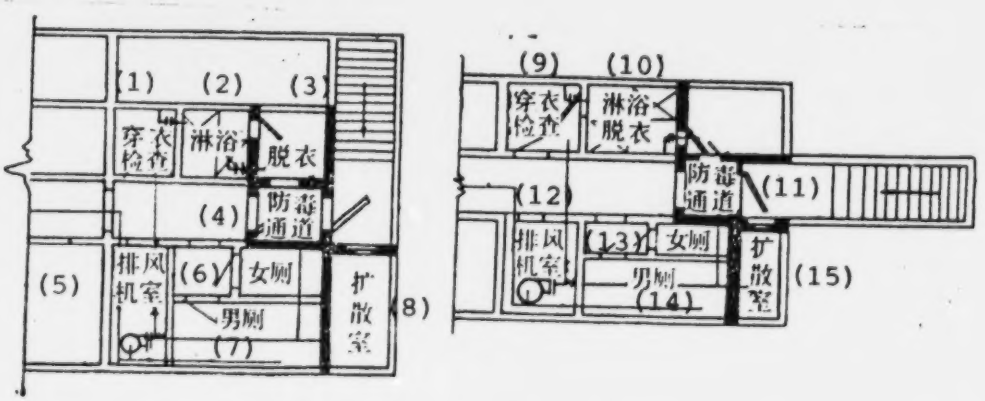

Figure3

Key:
1. Dressing examination
2. Shower
3. Undressing
4. Antitoxic passageway
5. Exhauster room
6. Women's toilet

7. Men's toilet
8. Diffusion room
9. Dressing examination
10. Shower, undressing
11. Gas protection tunnel
12. Exhauster room
13. Women's toilet
14. Men's toilet
15. Diffusion room

Generally, the air inlet should be placed in the secondary exit-entrance, while the diffusion room, toxic chamger, ventilator room and washroom should be set up on one side of the antitoxic passageway (see Figure 4).

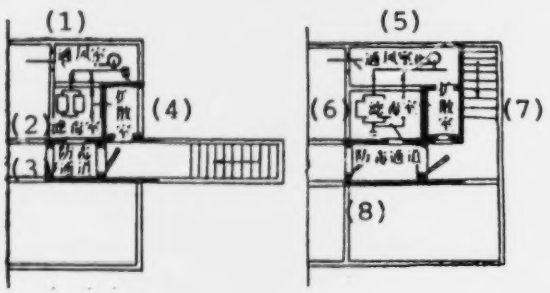

Figure 4

Key:
1. Ventilation room
2. Toxic filter chamber
3. Antitoxic passageway
4. Difussion room
5. Ventilation room
6. Toxic filter chamber
7. Diffusion room
8. Antitoxic passageway

The diffusion room, toxic filter chamber, antitoxic passageway and washroom should have floor drains or sweeping wells so that after the contaminated water is rinsed it can flow into the sewage pool of the opening's first door. Afterward, a water pump is used to eliminate the sewage water from the defense work without it going into the cleaning area.

5. Waterproof measures. In high-water-level areas, every attempt should be made to construct underground air defense shelters which widely use aggregate waterproof concrete with good antiseepage characteristics. The water repellence and density of the concrete itself is relied upon to attain waterproofing. Based on design requirements and operation rules during construction, when casting-in-place is completed, no construction joints are left. When there is a large amount of construction, no vertical construction joints should be left. Protruding or staircase type construction joints should be used (see Figure 5).

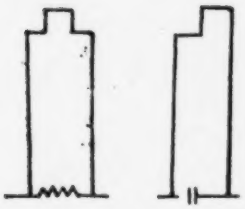

Figure 5

When pouring the upper layer of concrete, it is necessary to chisel off and wash away the pumice and floating paste from the joint. The same grade cement paste should be applied on the first layer and then the second layer of concrete poured, insuring that the new and old concrete combine to form a whole. The exit-entrance outside the shelter and the joining area of the main structure should have a settlement joint. Careful waterproofing should be carried out for each type of orifice.

6. Measures to prevent exit-entrance opening blockage. The exit-entrance opening is the weakest part of an underground air defense shelter. It is very easy to encounter building collapse blockage in densely populated areas and therefore it is necessary to adopt effective measures.

(1) Each independent underground air defense shelter should have at least two exit-entrance openings. They should be in a diagonal line so as to face different directions.

(2) Underground air defense shelters should have at least one exit-entrance opening outside the shelter, and as far as possible place it should be outside the collapsing range of the ground surface buildings (one-third the height of the building). The opening section can have a portable rainproof camouflaged room (see Figure 6) or light fireproof horizontal push and pull cover plate (see Figure 7). The preiphery of the opening should be 20-30 centimeters higher than the nearby ground.

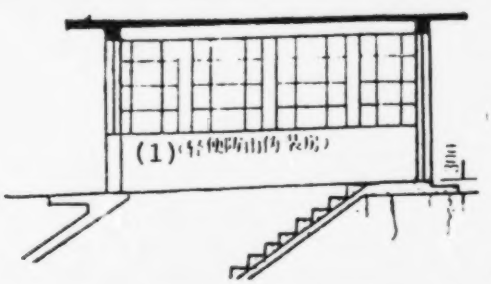

Figure 6 Key: 1. (Portable rainproof camouflaged room)

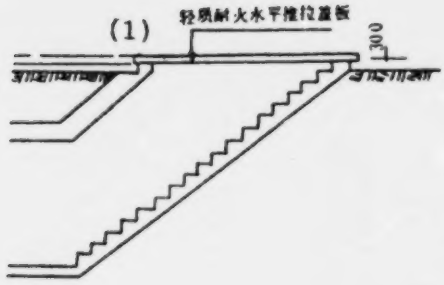

Figure 7 Key: 1. Light fireproof horizontal push and pull cover plate

When limited by conditions wherein the exit-entrance opening outside the shelter is erected within the collapsing range of the aboveground buildings, the opening section should have a sturdy collapse-resistant shed frame (see Figure 8).

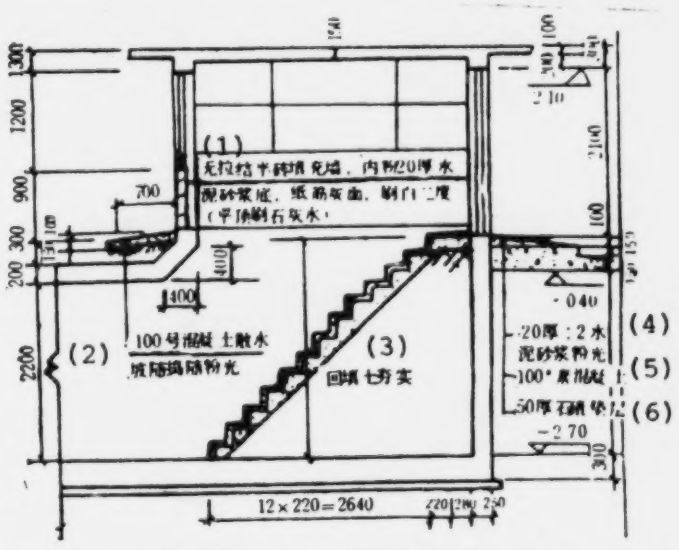

Figure 8 Key: 1. Non-tie half brick filled wall, inner powder 20 thick cement mortar base, paper reinforced mortar surface, white 2 degrees (flat-topped brushed rock mortar)
2. No. 100 concrete apron slope lights up powder as it is pounded
3. Backfill consolidation
4. 20 thick: 2 cement mortar powder light
5. 100 plain concrete
6. 50 thick ballast cushion course
[Dimensions given are presumably centimeters]

The light surrounding wall may be blown away by the shock waves of a nuclear blast, but the stability of the steel reinforced concrete columns and cover of the shed frame is good when enveloped by shock waves so that they are not easily destroyed. They can support the building's collapsing bricks and thus greatly reduce the blockage of the exit-entrance openings.

(3) The exit-entrance opening inside the shelter. Based on needs, a sturdy collapse-resistant shed frame can be set up in the shelter.

(4) Conditions premitting, the underground air defense shelter should, as far as possible, be connected with a civil air defense main passage not lower than the defense level of the main construction as well as with the adjoining civil air defense works.

(5) Each shelter area (section) of an underground air defense shelter should have two or three safety exits. Safety exits are the most effective means for saving people. Full use should be made of open ground for parking areas, factory yards, ball fields, parks, etc. The shallow buried small section horizontal passage should extend beyond the collapsing range, and low silo exits should be set up. The silo opening has a banded shut protective cover plate, and in the joining area of the horizontal passage and main section of the defense work a protective door is fitted which opens to the outside (see Figure 9).

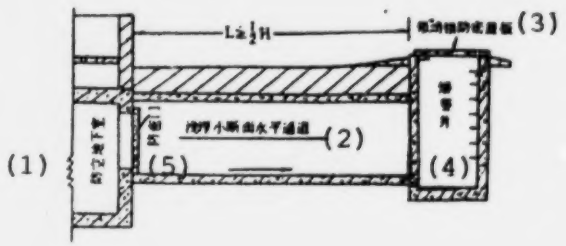

Figure 9 Key:
1. Underground air defense shelter
2. Shallow buried small section horizontal passage
3. Banded shut protective sealed cover plate
4. Low silo
5. Protective door

When conditions are limited and the safety exit can only be set up within the collapsing range, a silo type exit should be constructed. It can sustain shock waves and cause maximum horizontal thrust for the collapse of the building. The height of the silo should be at least one-fourth the height from level ground to the eaves and should exceed the estimated height of the collapsed brick accumulation. A banded shut swinging antiblast valve open to both inside and outside is fitted on the silo. A protective door and sealed door are fitted under the silo, and inside the silo there should be a hand climbing ladder. During wartime, they are safety exits, and in peacetime they are natural ventilation openings (see Figure 10).

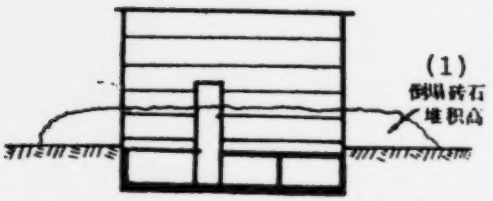

Figure 10 Key: 1. Height of collapsed brick accumulation

(6) Within 2 meters in front of the first protective door or sealed door of the underground air defense shelter and in the antitoxic passageway behind the door, cast-in-place steel reinforced concrete or plain concrete should be used to prevent the collapse of this passageway and the blockage of the door (see Figure 11).

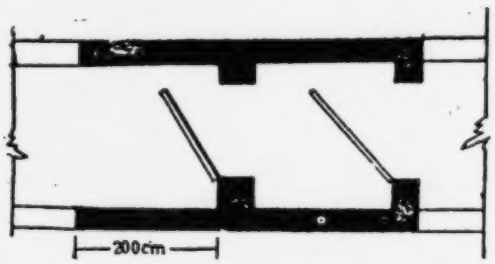

Figure 11

(7) Under certain conditions, a hoisting jack can be installed on the first door, or an opening device in case of accident can be installed on the door-frame (Figure 12) to open the door leaf when the door is blocked or in case of other accidents.

(8) A small room should be constructed next to the last door of the underground air defense shelter's main exit-entrance. During wartime, tools can be left there to clear away blockage from the opening.

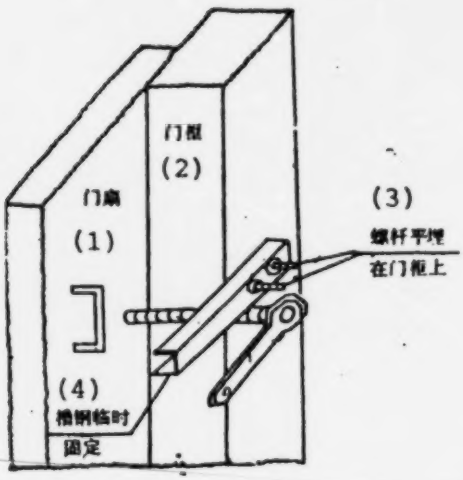

Figure 12 Key: 1. Door leaf
2. Doorframe
3. Bolts buried flat in doorframe
4. Channel iron temporarily fixed

The task of combining the construction of civil buildings with that of underground air defense shelters is very important. It involves a wide range of disciplines and strong technology; research is urgently needed on a great number of technological problems. Because my ideological level and professional abilities are low, there are many mistakes in this article. Thus, the reader is invited to offer criticism and make corrections.

9480
CSO: 4008/214

SINO-JAPANESE SOFTWARE CENTER

Beijing JISUANJI SHIJIE [CHINA COMPUTER WORLD] in Chinese No 5, 5 Mar 82

[Article by Yin Guangji [3009 1684 3444]: "Sino-Japanese Software Center Begins Activities"]

[Text] The Sino-Japanese Software Center was officially established in Beijing on 14 January 14. It was established as a result of the joint advocacy by Minister Qian Min [6929 2404] of the Fourth Ministry of Machine Building and president of Nippon Electric Company, Koboyashi Koji, in 1979 to promote Sino-Japanese cooperation in computer software technology. It is a technical cooperation project established on the basis of friendship and mutual benefits between the China Computer Technology Service Company and Nippon Electric. It has become the first example of cooperation in computer software technology between our nation and a foreign nation. It is being closely watched by concerned people at home and abroad.

A short computer training class for leading cadres was held on the day after the Sino-Japanese Software Center was opened.

The center will hold two managerial personnel training classes each year (the first class will begin on 12 May of this year), and two classes to train programmers and system analysts (this year, they will start classes on 24 February and 25 August, respectively.)

During the beginning period of the Sino-Japanese Software Center, Nippon Electric will send lecturers to China to teach. Later, Chinese technical personnel will gradually perform teaching functions.

The Sino-Japanese Software Center can also provide machine time for computer users and accept computational tasks, train hardware personnel, service ACOS series machines, provide technical support, answer user questions, design software systems, and demonstrate computer products. In addition, it will gradually create conditions for the exchange of high level software technicians of both nations and contract work to process foreign software products.

9296
CSO: 4008/213

MICROCOMPUTER USED IN MACHINERY TESTING DEVICE

Beijing JISUANJI SHIJIE [China Computer World] in Chinese No 5 5 Mar 82 p 8

[Article by Yuan [0337]: "Electrical Machinery Performance Testing Device Using a Microcomputer"]

[Text] A testing device using a DJS-051B microcomputer to process performance parameters of electrical machinery has been test produced jointly by the Shanghai Electrical Machinery Research Institute and the Shanghai Computer Applications Service Department. After several months of actual test use, it recently passed evaluation. The device can directly gather testing parameters of electrical machinery, carry out data processing, and print out the indices of various performances of electrical machinery in time. Previously, manual testing of one piece of electrical machinery required more than two days before results could be obtained. Now, it only requires half an hour, and some tests which cannot be read manually, such as the distribution of the temperature field in electrical machinery. can now be solved by using the device.

The hardware of the device consists mainly of the DJS-051B equipped with an A/D converter, a multiplex sampler, a variable transmitter and printout equipment. Special software was compiled during test manufacturing. At present, it can perform the following three tests: (1) It can perform the whole set of tests (i.e., no-load, loaded, temperature rise and m-s characteristics tests) for all types of asynchronous electrical motors with a capacity below 1KW-100KW and a voltage of less than 440V according to the international GB1032-68 standards. (2) It can measure the distribution of the temperature field of the windings in ventilation and heat dispersion tests of medium and small asynchronous electrical motors. (3) It can separately use the input/output method to measure the actual efficiency of the electrical motor or test the efficiency of the electrical motor according to the loss separation method. It can also be used to study the effect of the temperature of the surroundings on the correction coefficient.

9296
CSO: 4008/213

APPLIED SCIENCES

REAL-TIME DATA ACQUISITION SYSTEM DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTER WORLD] in Chinese No 4, 20 Feb 82 p 1

[Article: "Wuhan Postal and Telecommunications Sciences Research Academy Successfully Develops Real-time Data Acquisition and Processing System for Testing Spectral Attenuation in Optical Fibers"]

[Text] The Computer Applications Research Laboratory of the Wuhan Postal and Telecommunications Sciences Research Academy recently developed a real-time data acquisition and processing system for testing spectral attenuation in optical fibers. The system is based on the Z-80C level computer synchronized with a monochrometer. One scan during on-line operation can gather 22,500 rounds of samples and store 4,500 units of data. It can simultaneously gather samples, make computations, and produce output. After scanning ends, complete optical fiber attenuation curves can be obtained on the X-Y recorder. At the same time, the internal memory retains all computed results and attenuation curves and data of various types of specifications can be duplicated according to need.

The system was successfully tested in on-line operation in September of 1981. It has been operating for more than 3 months. It has actually measured more than 100 optical fibers. It not only can replace complex manual computations by workers, improve testing speed, provide complete and reliable scientific data, but also serves an active function to guide improvements of optical fiber manufacturing techniques and to improve the percentage of finished optical fiber products. It is profoundly welcomed by user units.

The system passed evaluation at the academy level smoothly last December 10, and it was praised by optical fiber testing workers and computer colleagues from various localities. They unanimously believed the system is the predecessor of microcomputers for testing spectral attenuation of optical fibers in the nation, and it is a typical and actual example of using the computer to carry out real-time data acquisition and processing.

9296
CSO: 4008/213

APPLIED SCIENCES

'LOOM-COMPUTER MONITORING SYSTEM' EVALUATED

Beijing JISUANJI SHIJIE [CHINA COMPUTER WORLD] in Chinese No 4, 20 Feb 82 p 1

[Article by Shu Hai [2885 3189]: "The 'Loom-Computer Monitoring System' of the Shanghai Cotton Mill No 28 Passes Evaluation"]

[Text] The evaluation meeting for the first phase of construction (controlling 504 looms) of the "loom-computer monitoring system" of the Shanghai Cotton Mill No 28 was held jointly by the National Computer Industry Bureau and the Shanghai City Computer Committee in Shanghai last December. The system was jointly organized and developed by the China Computer Technology Service Company and the Shanghai Textile Bureau. The Shanghai Textile Science Research Academy provided the overall plan. Shaoguan Radio Plant and Changzhou Radio Plant No 2 provided the equipment for the system.

The meeting believed this system is a success in technology and applications. The mainframe DJS112 computer used has a reliable and stable performance. The system has operated continuously without breakdowns for over 3,000 hours. Shangahi Cotton Mill No 28 has been using this system since May of 1981 and has realized visible economic results. Efficiency was improved 1 to 2 percent even when the original efficiency of weaving high density products was relatively high. According to the plant's calculated production value, all investment can be recovered in a year and three months.

The successful development of that system is a welcomed step in the application of the computer in the textile industry. Practice proves that this monitoring system is profoundly welcomed by the factory's managerial personnel and production workers. Their evaluation of the monitoring system is that the data provided by the computer are "accurate, timely, overall, unbiased," therefore "it possesses the greatest authority," the "computer room has naturally become the production dispatching center." Everyone generally understood that to realize modernization of business management, the computer must be used. This is because the monitoring system can truly reflect the current situation in the production process and provide various kinds of useful data so that the leadership and the workers will know what is going on and therefore they can exert their efforts at the right places.

9296
CSO: 4008/213

DESIGN OF DAUPHIN HELICOPTER'S ARRIEL IC ENGINE DETAILED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 8, Aug 82 p 11

[Article by Yu Wen [0060 2429]: "Dauphin Helicopter's Arriel IC Engine"]

[Text] The French aircraft engine industry employs approximately 22,000 people (the entire aerospace industry employs 100,300). The major engine companies include SNECMA and Turbomeca, whose main products are engines for military and civilian airplanes and helicopters, as well as turbines for ships. "Arriel" is a small turbo engine designed for light-weight single-engine or twin-engine helicopters.

The Arriel engine is a product of the 70's. Its prototype was the 650-hp Arriel IA, which was designed to replace products of the 50's and 60's: the Artouste engine and the Astazou engine. The initial design began in 1971; subsequently, it underwent two modifications: the Arriel IA2 and the Arriel IC, and the engine power was increased to 710 hp. Mass production of the engine began in 1977. Single Arriel engines are used on the "Ecureuil" and "Gazelle" helicopters; twin engines are used on the Dauphin helicopters. Its structure is as shown in Fig. 1. [not reproduced]

The Arriel engine design consists of five separate modules: axial-flow compressor, combustion gas generator, free turbine, accessory drive box, and transmission and speed reduction gear box.

The compressor consists of a single-stage transonic axial-flow compressor and a single-stage supersonic centrifugal compressor. This design is the product of many years of research and development of the Turbomeca Company. For a small turbo engine, a multi-stage compressor is not desirable because the smaller flow rate, narrower passages, and shorter blades tend to increase leaks and boundary layer losses. Also, small blades are more difficult to manufacture. Therefore, a mixed type compressor is more logical both from the design point of view and from the manufacturing point of view.

The rotor of the axial-flow compressor is an integral part made of titanium alloy, and its stator is an integral precision-cast part. The rotor of the centrifugal compressor has an integral flow guide impeller and a centrifugal impeller made of titanium alloy. To achieve the required pressure increase and flow direction, the impeller has both long and short blades.

The diffuser of the centrifugal compressor is also an integral part which consists of a radial diffuser and an axial diffuser. The axial diffuser has 58 blades; the single-stage centrifugal impeller has a pressure ratio of 5.25. Both the impeller and the diffuser are of advanced design, but they are rather difficult to manufacture.

Other components of the compressor are also of simple design. For example, the air intake is along the axial direction, and there are no guide vanes at the inlet. The guide cone in the air intake rotates with the compressor, and the interior of the guide cone is connected to the hot, compressed air so that deicing equipment is not required.

The engine has annular combustion chamber with a short and compact structure. In order to prolong the life of the combusion chamber, its outer and inner walls have several thousand drilled vent holes to provide complete air-film cooling.

The Arriel engine has three turbines, two of which are used to drive the compressor; one is a free turbine. In the prototype engine, all three turbines are of integral design; later the disk and the blades are separated because they are made of different materials, and they are attached to each other using tree shaped tenon gears.

The first-stage guide of the turbine is a welded part; it has hollow blades which are cooled by a branch of the compressed air flowing back to the combustion chamber. The second-stage guide is a precision-cast part; its blades have holes along the leading edge to allow air cooling.

The component structures of the Arriel engine are based on typical designs developed by the Turbomeca Company. The main features are:

(1) The engine is of modular design to facilitate repair and maintenance. It takes 24 minutes to assemble the 5 modules and 17 minutes to disassemble the engine.

(2) By using a high power starter, high energy igniter, and synthetic lubricating oil, good starting performance is achieved.

(3) The oil pump is of the full displacement type. It is equipped with sensors for measuring oil pressure, oil temperature, and vibration; it also has magnetic sensors and fire monitors so that any trouble can be discovered in time to allow appropriate action to be taken.

(4) The fuel regulator is developed by the Turbomeca Company. It uses the fuel itself to provide the control force so as to achieve fast response. When both engines are operating, it can automatically regulate the fuel supply to each engine to achieve balanced power distribution. In an emergency it can be operated manually to provide improved safety.

Compared with similar engines made in England or the U. S., the Arriel engine design has both advantages and disadvantages. It has a simpler structure because integral machined parts and precision-cast parts are used extensively. But the small dimensions, the high degree of precision, and the integral parts require new techniques and new craftsmanship in the manufacturing process.

3012
CSO: 4008/220

NEW TYPE STATIC PLOTTER BEING DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTER WORLD] in Chinese No 5, 5 Mar 82 p 10

[Article by Liu Zhankai [0491 0594 2818] of the Research Institute of Branch Plant No 1 of the Xian General Petroleum Prospecting Instruments Factory: "A New Type of Static Plotter"]

[Text] The computational speed and the functions of the computer are improving continuously and they are making higher and higher demands on the speed and reliability of output equipment. High speed plotters came about to adapt to this type of need. They can quickly plot various types of graphs and tables, curves and symbols for the user to analyze and study in time, thus greatly improving the efficiency of use of the computer. But the wide line printers and plotters presently in use are mostly mechanical. One shortcoming is that they make a lot of noise when in use. Another shortcoming is that there are technical difficulties in continually increasing the speed. Therefore, developing new types of static plotting devices became an urgent task. Our institute began in 1978 and spent over a year to successfully develop a new type of static plotter. Up to the present, two prototypes have been produced and they have operated for over one year. They have operated normally and their performance has been stable and reliable. They are now being produced in batches.

This new equipment uses advanced static printing techniques. The mechanical structure is new and the paper feeding system is ingenious. It is quiet, stable and reliable and its processing speed is fast. It not only can plot sectional drawings of earthquake times, velocity spectra, frequency spectra, it can also plot various types of graphs and tables, curves and symbols. The equipment can be connected to large, medium and small computers with appropriate interfaces. It is a relatively ideal general purpose peripheral equipment for computers.

The equipment consists of four parts: a writing head, a liquid toner system, a paper feed system and electronic circuits. It possesses two functions of plotting diagrams and characters. The printing speed for characters of 6,943 characters per second, the highest reaching 14,000 characters per second. The plotting of graphs can be done in high speed and low speed. High speed plotting can reach 19,500 lines per minute and

low speed plotting can reach 4,980 lines per minute. In low speed plotting, data requests between lines are locked for a longer time to guarantee a definite time for paper advancement. Both high speed and low speed data requests are realized by one negative pulsed signal with a cycle of 4 to 8 microseconds that requests the mainframe to transmit data.

The imaging principle of the plotter is as follows. A specially treated static recording paper passes under the writing head with a row of 2,112 pins. When writing is required, a certain group of charged pins produces a latent image at the corresponding positions on the static paper. The ordinary electrical resistance of the dielectric coating on the surface of this type of static paper is 10^{12} to $10^{16}\ \Omega$. Under the effect of a strong electric field over 550 volts, the resistance of the high resistance layer drops from $10^{16}\ \Omega$ to $10^{9}\ \Omega$. In this way, the information is stored and kept in the conducting layer. At this time, the paper has a strong adsorption of positive carbon particles. Even when the external electric field is removed, the stored information still remains on the paper. When the paper passes through the toner and is toned at three levels, a clear image is formed. A vacuum blade is attached at the end of the toner. On the one hand, it scrapes away excess fluids on the paper back into the ink bottle. On the other hand, it guarantees that the image on the surface of the paper comes out dry. This type of image can be stored for a long time without changing quality. When an image is drawn on transparent static paper, it can be copied.

9296
CSO: 4008/213

APPLIED SCIENCES

DOMESTIC COMPUTER FITTED WITH IMPORTED MAGNETIC DISK SYSTEM

Beijing JISUANJI SHIJIE [CHINA COMPUTER WORLD] in Chinese No 5, 5 Mar 82 p 10

[Article by Baochang [1032 2490] and Jie Bei [4105 0271]: "Domestic Computer Is Fitted With Imported EC-5561 Magnetic Disk System"]

[Text] The High Energy Physics Institute of the Chinese Academy of Sciences and the Shanghai Shipbuilding Technology Research Institute have successfully installed the Bulgarian EC-5561 (equivalent to the IBM-2314) magnetic disk subsystem on their domestically manufactured DJS-8 computers. They have begun operation.

The whole connecting plan of the High Energy Physics Institute was to regard the magnetic disk equipment as a subsystem to process system-to-system connections between itself and the mainframe system as the starting point. In interfacing techniques, the concept of the adaptor was used, therefore, an interface was provided between two types of different systems. It enables the two systems with different standards to satisfy the protocol of the interface. Both regard the connected object as possessing functional capabilities, thus, both sides of the interface regard the other as transparent. In this way, the magnetic disk interface adaptor has made it relatively easy to solve some relatively complex and difficult problems.

The whole assembly is stored in a small standard DJS-8 computer case. A total of 76 insert cards are used. Of them, 14 are medium scale integrated circuits or thick film integrated circuits, the rest is standard DJS-8 cards. Execution of operating commands and chain operations of commands to control the magnetic disk subsystem, to search, to write (format writing or non-format writing) and to activate readout can be realized via the interface adaptor of the magnetic disk. It can provide a total on-line capacity of 2x29MB for the mainframe.

The Shanghai Shipbuilding Technology Research Institute used a plan to "improve and expand the related logic functions of the mainframe and to add a special channel for use by the magnetic disk independently," and it successfully realized the connection. It also developed magnetic disk management software that is basically compatible with the resources of the original system within a short period. It transplanted the special data bank that was based on the magnetic disk memory and oriented towards scientific computation.

9296
CSO: 4008/213

BRIEFS

COMPUTER TO GROUP FREIGHT CARS--The ST-01A computer produced by the Shanghai Telecommunications Equipment and Materials Plant is being used to group railway freight cars. The operation is simple. It can correctly and quickly provide data needed in grouping freight cars. It has been welcomed by railway workers. The computer not only has the ordinary functions of a desk-top computer, but has added some memory and logic circuits. Pressing one key will complete successive additions and successive subtractions of three pieces of data simultaneously. If used in chemical engineering, metallurgy, commerce, transportation and warehousing and such other professions, the computer can complete other automatic computations and program controls with only a slight modification of program procedures. [Text] [Beijing JISUANJI SHIJIE [CHINA COMPUTER WORLD] in Chinese No 4, 20 Feb 82, p 1] 9296

CSO: 4008/213

LIFE SCIENCES

MORE MEDICAL FACILITIES BUILT IN BEIJING

OW120158 Beijing XINHUA in English 0101 GMT 12 Sep 82

[Text] Beijing, September 12 (XINHUA)--In the past three years this city has witnessed the biggest increase in medical housing since the founding of new China in 1949, according to a recent report published in BEIJING DAILY.

During this period, the newspaper says, 16 hospitals and 6 medical institutes have been built or expanded, adding a total floor space of 400,000 square meters. Investment in the projects amounted to 230 million yuan, much higher than the cumulative total during ten years of the "Cultural Revolution."

New in-patient and out-patient buildings, operating theaters and laboratories have been added to 17 of the 29 hospitals affiliated to the Academy of Traditional Chinese Medicine, Beijing Municipal Health Bureau, Beijing Medical College and Beijing No. 2 Medical College. A total of 137,000 square meters of housing has been added to 6 hospitals and institutes affiliated with the Chinese Academy of Medical Sciences. The expanded dental hospital now has a floor space over twice that before expansion, enabling it to receive over 2,000 patients each day--50 percent more than before.

Among the new establishments is a Cancer Research Institute and Hospital, the largest in the country, which will soon function as a medical, scientific and teaching center specializing in cancer in China, BEIJING DAILY reported.

Statistics from the Beijing Health Bureau by the end of 1981 showed that there were a total of 123 hospitals at county level and above in Beijing, and 264 commune hospitals in rural areas, with a total of 33,000 beds.

Clinics in all work units are responsible for the prevention and treatment of diseases of lesser severity and first-aid stations in urban areas and near suburbs of the city make emergency help more readily available for city dwellers.

In addition, tens of thousands of doctors and other health workers in health centers, which are distributed in neighborhoods and rural production brigades, deliver medical care right to local patients homes.

CSO: 4010/15

BRIEFS

PARIS NUCLEAR MEDICINE MEETING--The Third World nuclear medical science and biology meeting opened in Paris on 29 August. Some 3,000 representatives, including three Chinese researchers, were present. They are presenting many academic theses and introducing the latest achievements in the field. Nuclear medicine refers to medical treatment by the use of radioactive materials for diagnostic and therapeutical purposes. From the 1940's to the 1960's, it was necessary to use radioactive iodine to examine and treat thyroid gland diseases. In the 1960's, thanks to the availability of gamma ray photography and the latest radioactive medicines, nuclear medicine made remarkable progress. Currently encouraging results are being achieved, particularly in the examination of the functions of the thyroid gland, heart and lungs. In addition, nuclear medicine is also helpful in discovering certain cancers and the metastasis of a carcinoma at an early date. It is also used for therapeutical purposes. [Text] [OW020514 Beijing Domestic Service in Mandarin 1500 GMT 30 Aug 82]

BEIJING INSTITUTE PRODUCES ALPHA INTERFERON--Beijing, 7 Sep (XINHUA)--Scientists at Beijing's Institute of Virology for the first time have produced human alpha interferon, an antiviral and possibly anticancer substance, through the intermediary of E. coli, an intestinal bacteria, the Chinese Academy of Medical Sciences said today. Work on interferon production through genetic engineering began 4 years ago, and in 1981 institute scientists manufactured the first clinical-grade human alpha interferon, Professor Hou Yunde, head of the research group, said. The same year the group established an interferon messenger RNA translation system. This enabled them to set up a series of techniques to artificially induce, isolate, measure and purify the substance. Earlier this year, the professor said, they succeeded in isolating interferon messenger RNA, then were able to synthesize complimentary DNA, and after transformation, put it into E. coli for cultivation. Examination has shown the human alpha interferon produced in E. coli to be the same as the naturally produced substance. [Text] [OW071751 Beijing XINHUA in English 1247 GMT 7 Sep 82]

CSO: 4008/224

AUTHOR: None

ORG: Beijing Type No 3142 Internal Combustion Locomotive Test Group

TITLE: "Brief Report of Beijing Type Internal Combustion Locomotive Traction Hot Work Test"

SOURCE: Dalian NEIRAN JICHE [DIESEL LOCOMOTIVE] in Chinese No 7, 15 Jul 82 pp 53-56

ABSTRACT: The No 3142 internal combustion locomotive is the new product of the Beijing 27 Locomotive Plant. In keeping with the regulation of the Ministry of Railway, the locomotive was operated for 13,542 km on an actual railway line before the special diesel output Cardan shaft was installed for the test. The locomotive entered the test station on 25 Sep 81 to begin the traction capability test and all test items were completed on 9 Mar 82. During the second stage, under the simulated temperature conditions of 15, 27, 33, 40°C, the cooling property, the heat balance, the idle oil consumption of the cold and hot states of the diesel engine, the gear shift property of the transmission box, simulated high altitude work conditions, the mechanical resistance, and the start traction property of the locomotive were tested. The remaining test items followed. During the entire test period, the diesel engine was in operation 223 hours, the equivalent of 3,000 km run of the locomotive. All parts of the locomotive were found to be basically normal. On 22-23 Dec 81, a test report conference was called and the leaders of the ministry, the bureau, the section, and the plant listened to the conditions of the tests. An excerpt of the report is reproduced in the paper. [The dates appear to be in error, but they are the dates given in the paper.]

6248
CSO: 4009/386

AUTHOR: LIU Changnian [0491 7022 1628]

ORG: Beijing Aeronautical Engineering College

TITLE: "Analysis and Design Methods of Inner Force Disturbed Loading System"

SOURCE: Guangzhou JICHUANG YU YEYA [MACHINE TOOL & HYDRAULICS] in Chinese No 4, 1982 pp 1-12

TEXT OF ENGLISH ABSTRACT: Analysis and design methods of inner force disturbed loading system, such as used in material testing machine, vibro-bench, braking system, and fatigue testing machine, are introduced in this paper. Mathematical model of loading system is obtained. Inverse resonance point, available working region and unavailable working region are discussed. A new kind of method of seeking roots of three order characteristic equation and the way of improving rapidity of a system are given. Moreover, the calculating method of maximum travel of hydraulic cylinder and the method of finding the optimum matching parameters, etc. are obtained.

AUTHOR: LIU Guokun [0491 0948 1507]
DONG Muguang [5516 1970 0342]

ORG: LIU of Shaoyang Hydraulic Elements Plant; DONG of Jinan Casting and Forging Machine Research Institute, First Ministry of Machine Building

TITLE: "Axial Piston Pump With Constant Pressure and Variable Displacement 63PCY14-1B"

SOURCE: Guangzhou JICHUANG YU YEYA [MACHINE TOOL & HYDRAULICS] in Chinese No 4, 1982 pp 16-18

TEXT OF ENGLISH ABSTRACT: Constant pressure and variable displacement axial piston pump (model 63PCY14-1B) is developed by Jinan Casting and Forging Machine Research Institute and Shaoyang Hydraulic Elements Plant; its mechanism for varying delivery can automatically change the flow with load, while the pressure remains regulated one. The pump is especially suitable to the systems which are continuously operated at almost zero flow for a long time. Compared to the system with fixed displacement and flooding valve, the system with the new pump can save power by 30 to 85 percent.

10424
CSO: 4009/393

AUTHOR: LYU Lin [0712 2651]
ZHAO Chunjun [6392 4783 0971]

ORG: Both of Qinghua University

TITLE: "Some Applications of Automation Technology to Energy Saving In Industrial Enterprises"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 3, 1982 pp 2-10

ABSTRACT: Through a summarization of foreign literatures, mostly of USA origins, this paper introduces the following examples of foreign conditions of applying automation to save energy: (1) A mathmatical model of the motion of an automobile engine and its optimized control; (2) The design of a control system for saving the fuel of an oil-burning boiler; (3) The temperature of an experimental resistance furnace controlled by a microprocessor; (4) System analysis for energy saving in iron and steel industries; (5) Optimal dispatch of an electrical power system; (6) The energy management system of the Westinghouse Company. In view of the party's policy of simultaneously developing energy sources and conserving energy while in the near future putting more emphasis on energy conservation in China, the authors believe some of these techniques introduced in the paper that are well developed [in foreign countries ?] highly efficient, and requiring very little capital investment, should be studied and extended in China.

AUTHOR: CAO Guangchuan [2580 0342 1557]

ORG: Design Academy No 8, Ministry of Machine Industry

TITLE: "Positioning Accuracy Analysis of PR-120 Balancing Arm Type Industrial Robot"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 3, 1982 pp 11-20, 33

ABSTRACT: This paper summarizes the characteristics of the general purpose balancing arm of the industrial robot PR-120, without mentioning the designer or the manufacturer of the robot. The positioning accuracy of the arm is analyzed in the following aspects: (1) Effect of the strength of the arm under load; (2) Effect of the weight of the arm itself; (3) Effect of pulse vibration of the arm in the process of positioning; (4) Effect of machining errors with respect to the size of the arm; (5) Effect of gaps of horizontal and vertical guides. The key problems of research on this type of heavy load balancing arm robot are believed to be positioning accuracy and load capacity. Theoretical analysis and experimentation have proved the design of the hollow-box shaped arm structure, made of welded thin steel plate, with a flat and wide rectangular section, to be satisfactory as the balancing arm of the heavy duty industrial robot.

AUTHOR: ZAN Fuxiang [2501 4395 4382]

ORG: General Bureau of Meters, Ministry of Machine Industry

TITLE: "Development of Small Scale Automatic Control Meters and Instruments to Serve the Reconstruction of Existing Industries"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 3, 1982 pp 48-50

ABSTRACT: The existing industries of China have technically backward machines. The energy consumption is high, the product quality is poor, the efficiency is low, and the pollution results are very serious. This condition is especially true with the light industry. There are many small and old plants and most of them have very old machines and depend more or less on manual labor. In recent years, the instrument and meter industries have made thousands of items in assembled sets of automatic control meters and instruments. When they are used or installed onto the existing machines, they produce obvious effects of saving energy, improving the quality of products, increasing labor efficiency, reducing labor intensity, and contributing to safety. Their extension will make it possible to reconstruct the existing machines quickly. These automatic control meters and instruments introduced in the paper include simple meters for automatic control and regulation of the water intake system of boilers, the zirconium oxide analyzer, etc. to measure the CO_2 and O_2 contents of the smokestack to proceed with feedback regulation and control, the automatic meter control of the fatty acid synthesis process, simple meters to control the temperature, humidity, etc. Samples of factories using these meters to upgrade their production facilities are given.

6248
CSO: 4009/389

Prospect Engineering

AUTHOR: ZOU Zhihua [6760 4249 5478]

ORG: None

TITLE: "Thirty-two Years of Pit Prospecting Engineering in China"

SOURCE: Beijing TANKUANG GONGCHENG [PROSPECT ENGINEERING] in Chinese No 4, 20 Aug 82 pp 5-7

ABSTRACT: The foundation of geological prospecting work in China was very weak before the liberation. There were about 10 old fashioned drill machines to carry out some surface stripping projects and nothing else to speak of. After the liberation, pit prospecting engineering has been gradually adopted as one of the major techniques by departments of geology, metallurgy, coal, machinery, construction materials, chemical engineering, hydroelectric power, railways, and transportation. Pit prospecting techniques allow the geological prospectors to enter the ore body and the country rock to observe and study directly in order to take correct samples according to the changes of the bedded deposit and the gallery used for the prospecting work may also be used for future mining. This method of prospecting is especially effective and indispensable for prospecting scattered, rare, and nonferrous metals. In these 32 years, it has been used to locate more than 50 ores, including coal, iron, chromium, crystals, gold, diamond, mica, lead-zinc, copper, molybdenum, and uranium, and its reliability has been verified. Since 1964, pit prospecting specialty training classes have been established in many geological colleges and schools and the machines and the work processes have been continuously improved as well. The progresses and achievements of these 32 years are briefly reviewed. This paper was originally published in DIZHI LUNPING No 4, 1982.

AUTHOR: DU Xianglin [2659 4382 2651]

ORG: None

TITLE: "Thirty Years of Development in Geological Bore Prospecting Equipment"

SOURCE: Beijing TANKUANG GONGCHENG [PROSPECT ENGINEERING] in Chinese No 4, 20 Aug 82 pp 7-10

ABSTRACT: Although the blast force technique was used in China to bore several hundred feet into salt wells as early as 600 B.C. and as deep as 2,000 feet in 1500 A.D. the bore technique had fallen backward in the past century. The earlist mechanical boring these days is traced to a USA company in its prospecting work for lead-zinc and silver in Yunnan Province in 1900. In 1931-1945, Japanese companies also used some manually operated drills for mineral prospecting in the Northeast and North China during its occupation period. In 1949 to 1981, great progress has been made in terms of designing and manufacturing of drilling equipment and of training of specialized teams. This paper reports the progress in the four stages of 1952-1957, 1958-1967, 1968-1976, and 1977-1982, after giving a description of the condition of pre-liberation days. There are 4 photos depicting the old and the new drilling equipment and a section discussing the directions of future efforts in this field.

6168
CSO: 4009/392

AUTHOR: GUO Bingran [6751 0014 3544]
XI Zhifa [1153 1807 4099]

ORG: Both of Zhejiang University

TITLE: "System Analysis of Turbine Vacuum and the Optimization of the Circulative Pump Operation"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 82 pp 219-222

TEXT OF ENGLISH ABSTRACT: This paper deals with the application of preview control to cooling systems of power plants. The operation with control can result in a saving of power and an increase net power of power plant. The optimization of turbine vaccum depends, mainly, upon the ambient conditions and the load. A mathmatical model of system analysis and the computer program are presented for determining the optimal preview control policy. The algorithm is applied to all kinds of turbine unit. The preview control is shown to be substantial improvement over the uncontrolled case.

AUTHOR: ZHANG Defu [1728 1795 3940]
YA Weizhong [0068 4850 1813]

ORG: Both of Research Institute of Engineering Thermophysics, Chinese Academy of Sciences

TITLE: "A Multichannel Automatic Pressure Measuring System With High Accuracy and Low Cost"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 82 pp 315-321

TEXT OF ENGLISH ABSTRACT: Starting from the basic principle of the pressure transducer, a detailed analysis is made in this paper on the various errors likely to occur in the pressure-measuring system. Then, a complete set of methods to eliminate and control those systematic errors is presented. Taking advantage of a computer, a modern data processor, and a valve, named "multichannel panel type valve," created from an original design, the above reasonable idea was implemented. Using this new method, although the total error of ordinary home-made transducers may be as high as a few percentages, most of the transducers attained a full range pressure measuring accuracy better than 0.1 percent. The environment temperature surrounding the transducers is allowed to change slowly. The cheapest DC voltage regulator may be used as the power supply of the transducers.

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NATIONAL DEVELOPMENTS

OVER 900 POSTGRADUATES FOR DOCTORAL DEGREES TO BE ENROLLED

Beijing RENMIN RIBAO in Chinese 29 Aug 82 p 3

[Article: "119 Institutes of Higher Learning and Scientific Research Organizations in the Country Plan to Enroll More Than 900 Postgraduates for Doctoral Degrees This Year"]

[Text] According to the XINHUA News Agency, China plans to enroll more than 900 postgraduates for doctoral degrees in 1982. The recruitment of students will begin in the latter part of August.

In 1982, a total 119 institutes of higher learning and scientific research organizations (excluding the Chinese Academy of Social Sciences) will enroll postgraduate students for doctoral degrees. These will include 691 students planned for enrollment by 92 institutes of higher learning with 412 specialities [Zhuanye dian 1413 2814 7820] and 509 advisors; 145 students by the five academic departments of the Chinese Academy of Science with 61 specialities and 104 advisors; 44 students by 17 ministries and commissions under the State Council and provincial and municipal scientific research organizations with 27 specialities and 32 advisors, and 24 students by five military schools with 17 specialities and 23 advisors.

According to the "Provisional Regulation for the Enrollment of Postgraduate Students for Dcotoral Degrees" (referred to as Regulations below), persons meeting the following requirements may register for examinations for doctoral students this year: (1) familiar with the basic principles of Marxism-Leninism and Mao Zedong Thought and adherence to the four basic principles of good conduct, discipline and law abiding, diligence, and determination to serve the modern construction of socialism; (2) working persons with a master's degree, students due to receive their master's degree (able to receive a master's degree before acceptance at the latest), or persons with equivalent scholastic ability; (3) in good health and, in general, less than 40 years of age; (4) recommendation by two assistant professors (or persons with equivalent title) or higher ranking specialists in the applicant's related field.

The application date will be determined by individual enrollment units. Applicants meeting the requirements may review the "Catalogue on Special Subjects for National Enrollment of Postgraduates for Doctoral Degrees in 1982" released by the Ministry of Education at the admissions offices of the nearest provincial,

municipal, or autonomous region institutes of higher learning or related institutes of higher learning and scientific research organizations.

The "Regulation" emphasizes that at the time the person meeting the requirements makes his application the unit where he is located must transmit the following documents to the enrolling unit: application for examination of doctoral student, letters of recommendation from specialists, transcripts for the master's degree, master's thesis and evaluation, master's diploma or certificate, physical examination paper, and political evaluation paper. Students due to receive their master's degrees must submit their master's diploma before acceptance. Persons with equivalent scholastic abilities will not be required to submit materials related to master's transcripts and diplomas, however, they should submit a list of courses taken towards master's degrees and academic papers published in public publications which are equivalent to a master's thesis.

The "Regulation" also states that this year's enrollment of postgraduate students for doctoral degrees combines examinations with recommendations and written examinations with oral examinations. Subjects of examination generally include theories of Marxism-Leninism, foreign languages, and professional topics. The number of professional topics is determined by the enrolling unit. In addition to written and oral examinations, the enrolling unit may require other necessary tests. The examination date is determined by the individual enrolling units.

The "Regulation" points out that the training goals for the enrollment of postgraduate students for doctoral degrees are: overall moral and intellectual development, a firm and broad grasp of basic theories and an in-depth specialized knowledge in the specific field of study, possession of independent ability for scientific research, and high level scientific and specialized talents with creative results in science or special technology. Therefore, it is hoped that the units will proceed from the overall situation, actively support personnel meeting the requirements, and provide talent to the state.

5974
CSO: 4008/222

FIBER-OPTIC ANGULAR RATE SENSOR WITH STABILIZER CIRCUIT DESCRIBED

Shanghai JIGUANG [LASER JOURNAL] in Chinese No 12, 1980 pp 32-35

[Article by Yan Wanchang [7051 8001 2490], National Defense Scientific and Technical University: "A Fiber-Optic Angular Rate Sensor with a Stabilizer Circuit"]

[Text] ABSTRACT: The addition of a stabilizing feedback circuit to a polarized ring laser interferometer is described. The compensation method is used to measure optical path difference, thus allowing increased stability of the angular rate sensor output and decreased interference error and ensuring accuracy.

Introduction

Since 1963 the laser gyroscope has been attracting great attention everywhere. Because it has no moving parts, its spinup time is short, its power consumption is small and it can withstand high acceleration and impact, it has great promise for use in flight, including applications to missiles and space flight. As a result of more than 10 years of energetic research and development work, such devices as the GG-1300 laser gyroscope have been developed [1]. But its temperature sensitivity and proneness to frequency locking are hindering the improvement of its capabilities [2], so that it has not gone into extensive use. The main problems of instability and frequency locking caused by heat production in the active ring resonator and scattering and losses in the mirrors are hard to solve. Major efforts in recent years have produced some progress, such as the development of the differential laser gyro design [3], and have partially solved this problem, but reports indicate that it is still in the developmental stage. Recently, passive-resonator laser gyros [4] and fiber-optic gyroscopes [5-8] have been proposed. These gyroscopes or angular rate sensors have no frequency lock-in region and their stability is good, so that they have overcome the difficulties encountered in the case of active ring-laser gyroscopes, but their sensitivity is still rather poor. One way of solving this problem is the use of a stabilizer circuit to create a closed-loop system, which is in reality a compensation method. This method has been extensively used in many types of measuring equipment and has been shown

to be effective. The present article discusses the operating principles of such a laser angular rate sensor and presents block diagrams and a proposed design implementation.

Operating Principles

The operating principles are illustrated in Fig. 1. The directionally stable coherent light emitted by laser L passes through a 45° polarizer plate P to beamsplitter B, which divides the beam into two beams of equal intensity. One beam passes through polarizer P_1, which gives it p-polarization, then is reflected by oblique mirror M_1 and is passed through a quarter-wave plate to give it left-handed circular polarization; after passing through Faraday cell F it passes through another quarter-wave plate. This plate must be so located that when the left-hand circularly-polarized beam passes through it, it becomes s-polarized. The beam then passes through polarizer plate P_2 perpendicular to P_1, then proceeds to beamsplitter B, completing a circuit, and is reflected. Similarly, the other beam exiting from the beamsplitter completes a circuit in the opposite direction through P_2, M_2, one quarter-wave plate, F, the other quarter-wave plate, M_1, P_1 and B. Obviously this beam is s-polarized after passing through P_2, and when it passes through the first quarter-wave plate it becomes right-hand circularly-polarized; then, after passing through the second quarter-wave plate, it becomes p-polarized. Thus when the two beams exit via B they form a combination of p-polarized and s-polarized light.

When this optical circuit is not rotating around an axis perpendicular to the plane of the laser path, the two beams travel equal paths, and when exiting from B they have the same phase, so that the composite beam should be linearly polarized at 45°. When the circuit is rotating around an axis perpendicular to its plane, the counterrotating beams have an optical path difference. The beam traveling in the direction of rotation has an increased path length and that traveling in the opposite direction has a decreased path length. Then the two beams exiting from B will have different phases, and the product of their combination will be elliptically polarized. The direction of rotation of this elliptically polarized beam will be the same as the direction of rotation of the system.

In order to extract the information from this beam we use a lithium niobate electrooptical modulator N. The lithium niobate crystal passes light along its Z axis, while a voltage is applied along the Y axis, producing a transverse electrooptic effect. When the voltage satisfies the condition

$$V = \frac{\lambda}{4 n_0^3 r_{22}} \cdot \frac{d}{l} \qquad (1)$$

the effect of the crystal is equivalent to that of a quarter-wave plate. In the formula, λ is the wavelength of the light, n_0 is the principal refractive index of the crystal for the ordinary wave, r_{22} is an element of the electro-optical coefficient matrix for the crystal, d is the thickness of the crystal between the electrodes, and l is the length of its Z axis. The crystal is mounted so that its Y axis is at an angle of 45° to the direction of polarization of the p-polarized and s-polarized waves. The voltage applied to the crystal is a square wave with the voltage given by equation 1.

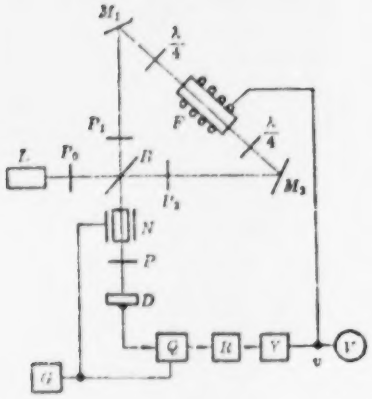

Fig. 1. Operating principles of device.

With no rotation in the system, when the p-polarized and s-polarized beams, which have the same phase, pass through the crystal during the positive half-wave of the applied voltage they are combined into a circularly-polarized beam, and during the negative half-wave they are combined into a circularly-polarized beam with the opposite direction of rotation. The composite beam exiting from the crystal passes through an analyzer P oriented along the Y axis of the crystal, then is received by photodetector D which converts it to an electrical signal. Obviously a transformed signal in which the amplitudes corresponding to the positive and negative half-waves of the crystal modulating voltage are equal will be obtained.

When the system has a rotational input, the phases of the p-polarized and s-polarized beams will differ when they enter the crystal, and as a result of modulation in the crystal the voltage produced by the detector will have different amplitudes in the positive and negative half-waves. By comparing these signals in a phase detector, an AC output voltage which is a certain function of the input rotation can be obtained. The linear reference circuits of phase detector Q and comparator R are shown in Fig. 2. In the figure, u_1 and u_2 are AND gates and f is a NOT gate: u_1 outputs the signal for the first half-wave and u_2 outputs that for the second half-wave. The two signals

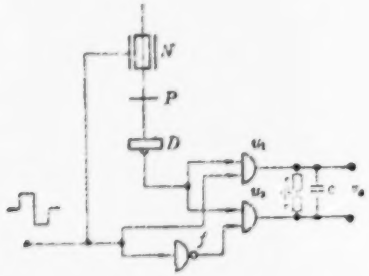

Fig. 2. Linear reference circuit of phase detector and comparator.

are compared by applying them to the two arms consisting of resistors r, and filter capacitor C yields a DC output signal v_g.

In an open-loop system, the signal v_g is amplified to v and constitutes the rate sensor output: its positive or negative value indicates the direction of rotation. For a rate sensor with a stabilizer circuit, i.e. a closed-loop system, the signal v must be fed back to the winding of the Faraday cell F in the ring resonator, thus correcting the path difference of the counter-rotating beams. The output signal v is still used as the rate sensor output, and can be read out during experiments as a digital voltage value V.

Block Diagram of the System

For simplicity we assume that the two beams are propagating in opposite directions around a circular path (Fig. 3). The angular velocity of the

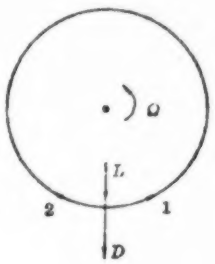

Fig. 3. Optical rotation system.

system is Ω, and the laser L and detector D are both in the rotating system. Thus the light is emitted from L and propagates in two different directions around the circular path to point D, when the path difference Δ of the two beams is:

$$\Delta = \Delta_1 + \Delta_2$$

where Δ_1 and Δ_2 are the differences in path length imparted to beams 1 and 2 as a result of the rotation. They can be determined from the formulas

$$\frac{\Delta_1}{\Omega R} = \frac{2\pi R}{c}$$

$$\frac{\Delta_2}{-\Omega R} = \frac{2\pi R}{c}$$

where R is the radius of the circular path and c is the speed of light. Thus we obtain

$$\Delta = \frac{4A}{c}\Omega \qquad (2)$$

where $A = \pi R^2$ is the area enclosed by the optical path. It can be proved that equation 2 is equally valid for a noncircular path.

If the phase difference between the two beams is φ , then φ and Δ will be proportional:

$$\varphi = \frac{2\pi}{\lambda} \Delta \qquad (3)$$

If the wave formulas for the two beams before they pass through the crystal are

$$i_1 = I \sin \omega t$$
$$i_2 = I \sin (\omega t + \varphi)$$

where I is the optical intensity for each beam, then after they have passed through the electrooptic modulator crystal the formulas are

$$i_1(+) = I \sin\left(\omega t + \frac{\pi}{2}\right)$$
$$i_2(+) = I \sin (\omega t + \varphi)$$

for the first half-wave and

$$i_1(-) = I \sin\left(\omega t - \frac{\pi}{2}\right)$$
$$i_2(-) = I \sin (\omega t + \varphi)$$

for the second half-wave. When depolarizer P has the same direction as the Y axis of the crystal, the combination of the two waves after passage through P will be

$$i_y(+) = -i_1(+)\cos 45^\circ + i_2(+)\sin 45^\circ$$

for the first half-wave, from which we can determine the amplitude of the combined beam (in the Y direction):

$$I_y(+) = \sqrt{2} I \sin \frac{\varphi - \frac{\pi}{2}}{2}$$

Similarly, in the second half-wave we have

$$I_y(-) = \sqrt{2} I \sin \frac{\varphi + \frac{\pi}{2}}{2}$$

When the light intensities from the two half-waves are converted into electrical signals by the same photodetector, passed through phase detectors and applied to the two resistors for comparison, the output voltage v_g is

$$v_g = K_g 2I^2 \sin \varphi$$

where K_g is the conversion factor for the photodetector and phase-detector-comparator unit. For a closed-loop system with negative feedback, φ will be very small, so that

$$v_g \approx K_g 2I^2 \varphi \qquad (4)$$

Signal v_g can be proportionately amplified by a linear amplifier, but in order to eliminate steady-state error and high-frequency noise an integral amplifier may be used. Its transfer function may be written as

$$W(S) = \frac{K_v}{S}$$

where K_v is the proportionality factor of the integral amplifier and S is the

Laplace operator. Thus the amplifier output voltage is

$$v = \frac{K_v}{S} v_p \qquad (5)$$

If the conversion factor for the Faraday cell is K_F and the optical path which it compensates is Δ', then

$$\Delta' = K_F v \qquad (6)$$

Using the conversion relationships of equations 2-6 we can draw a block diagram for the stabilizer-circuit optical angular rate sensor as in Fig. 4.

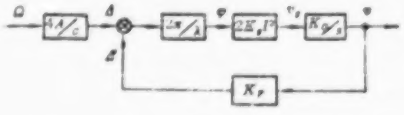

Fig. 4. Block diagram of system.

From the block diagram we obtain

$$v = \frac{K_\Omega}{TS+1} \Omega \qquad (7)$$

where $T = \dfrac{1}{K_v 2K_g I^2 \frac{2\pi}{\lambda} K_F}$ is the time constant of the system and $K_\Omega = \dfrac{4A}{CK_F}$ is the scale factor for the laser angular rate sensor. It is apparent from equation 7 that the system has a typical aperiodic characteristic. In a steady state,

$$v = K_\Omega \Omega \qquad (8)$$

gives the simple linear relationship between the output voltage and input angular velocity. Eq. 8 indicates the special characteristics of the laser angular rate sensor when equipped with a stabilizer circuit. The scale factor and the steady-state precision are related only to the conversion factor K_F of the feedback element and the area enclosed by the optical path and are unaffected by other parameters. Increasing A is an effective way of increasing the sensitivity of the sensor, while decreasing K_F affects the feedback function. Using the polarization interference method increases the resolution of the detector, raising its detection threshold. The degree of instability A/K_F is the steady-state relative error of the sensor. The system is not sensitive to constant interference and has little response to high-frequency interference, but it still has error produced by such dynamic interference as amplifier drift, photodetector noise and instability in the light intensity and light source directionality. By suitably choosing the system time constant T, these types of interference can be decreased.

A Proposed Design

A simple design proposal is shown in Fig. 5. A helium-neon laser or semiconductor laser may be be used for L. After passing through a 45° polarizer plate P_0 the light is divided into two beams of equal intensity by a beam-splitter; one beam passes through polarizer plate P_1, a quarter-wave plate and condenser T_1, then into an optical fiber, while the other beam passes through P_2, a half-wave plate, Faraday cell F and condenser T_2, then into the optical fiber. The fast axes of the two quarter-wave plates must be parallel so that the two counterrotating beams passing through the Faraday cell and optical fiber will be circularly polarized and so that when leaving the circular optical path they will be linearly polarized in mutually perpendicular directions. The feedback output circuit is as described above and will not be discussed again here. This device is packaged as a single unit and has no moving parts.

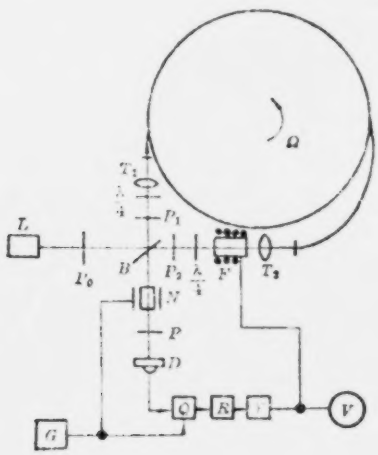

Fig. 5. Diagram of proposed design.

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8480
CSO: 8111/1799

PREVENTION, TREATMENT OF OCCUPATIONAL DISEASES STUDIED

Beijing RENMIN RIBAO in Chinese 18 Jul 82 p 3

[Article by Sun Yongsheng [1327 3057 4141]: "Tianjin Actively Expands Work to Prevent and Treat Occupational Diseases"]

[Text] The Tianjin Municipal Public Health Bureau has adopted practical measures to expand work to prevent and treat occupational diseases. Since 1979, they have conducted health inspections of the work environment in over 2,000 factories, and physically examined 90,000 workers whose work involves dust or toxic substances, in order to protect the health of the staff and workers.

Since the Third Plenum of the 11th Party Central Committee, the City of Tianjin has restored and strengthened organizations for industrial hygiene and the prevention and treatment of occupational diseases. Personnel and facilities have been increased. The Municipal Public Health Bureau has allocated almost 2,000,000 yuan for work in industrial hygiene and the prevention and treatment of occupational diseases. In all wards of the city, the county public health and epidemic prevention stations have set up labor health sections (teams), while the hospitals of each ward have set up an occupational disease section. Since 1979, almost 1,000 medical personnel have been organized throughout Tianjin, to go right to the factories where work is done involving dusts and toxic substances to carry out surveys of many kinds of ailments. In conducting the survey, they adhered to the principle of simultaneous investigation, treatment, and prevention. By the end of last year, they had discovered 1,864 persons suffering from occupational diseases caused by the 5 toxic substances, lead, benzene, mercury, organic phosphorus, and trinitrotoluene. They treated 1,850 persons, or 99.2 percent. The municipal public health and epidemic prevention stations, in cooperation with the relevant industrial departments, also carried out investigations for occupationally related tumours at 159 factories.

While making the survey of occupational diseases, the public health departments made suggestions for improvements in production technology and safety equipment in the factories where work is done involving dust or toxic substances. Eight hundred and seven factories worked out measures for improving working conditions.

Recently, the Tianjin Municipal Public Health Bureau joined together with the Municipal Economic Commission, the Trade Union Federation, the Labor Bureau, and the Medical Management Bureau, to hold a city-wide meeting to sum up the occupational diseases survey, and to commend 33 advanced collectives and 40 advanced persons for their achievements in the occupational disease survey and in the work to bring the hazards of dust and toxic substances under control.

12187
CSO: 4008/207

LIFE SCIENCES

NEW MODEL CARDIOVASCULAR CARDIOVERTER DEVELOPED

Guangzhou GUANGZHAOU RIBAO in Chinese 28 Jun 82 p 1

[Article by reporter Ye Lifei [0673 7787 5481]: "A new Model Cardiovascular External Cardioverter Successfully Developed in Guangzhou; 90 Percent Effective in Treating Angina Pectoris of Coronary Heart Disease"]

[Text] At the recently concluded "WFB-II Model Sequential Type External Cardioverter Evaluation Meeting:, a reporter from this newspaper learned that the Guangzhou Medical Apparatus and Instruments Factory and the Artificial Heart Laboratory of the Zhongshan Medical Academy have succeeded in developing through cooperative research a new model cardiovascular external cardioverter, which has a far greater curative effect than the usual sequential type cardioverter applied to the four limbs. The new device is 90 percent effective in treating the anginal pain of coronary heart disease. The experts from 29 provinces and cities unanimously concluded that the sequential external cardioverter, which has been developed first in China, is a new achievement in the technology of treating coronary heart disease and diseases involving insufficient blood to the brain.

At present, the external cardioverter used in foreign countries is, for the most part, the non-sequential positive/negative pressure cardioverter, which is applied to the legs. Since this type of device is not rational in design, the diastolic pressure cannot be raised to the appropriate level. As a result, it is gradually falling into disuse. The scientists and technicians, and the technical personnel of the Guangzhou region have been making bold innovations and tackling key problems together for many years. In 1976 they successfully developed the Model I external cardioverter. In order to further improve effectiveness, the Guangzhou Medical Apparatus and Instruments Factory and the Zhongshan Medical Academy have carried out meticulous research since 1980, successfully developing the new model WFB-II Sequential External Cardioverter. This new model device is far more effective, and is a significant advance over the original Model I in terms of the performance of its electrical and mechanical systems. In clinical use, the symptoms of angina pectoris disappeared in 90 percent of the cases; there was a significant improvement in the remainder of the cases, many patients who were seriously ill improved rapidly. One patient had suffered anginal pains for over 20 years. Before treatment he would suffer heart

pains and shortness of breath when walking quickly on level ground for 20 meters, or when bathing, or eating. During serious spells he would suffer pain 3 or 4 times daily. After 36 cardioversion treatments using this new model device, the symptoms rapidly improved. After terminating the use of all medications for anginal pains, the patient was able to climb five stories without heart pains or shortness of breath. He was also able to climb the 200 meters to Tian Lake in Conghua County, ascending and descending the slope just like everyone else.

12187
CSO: 4008/207

AUTHOR: PAN Chengpan [3382 2110 3140]

ORG: None

TITLE: "Accuracy Estimation and Testing for Fire Contral System of Antiaircraft Weapons"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 3, Aug 82 pp 1-12

TEXT OF ENGLISH ABSTRACT: This paper deals with the method of describing the accuracy of the fire control system of aircraft weapons during firing and studies the principle and method of the accuracy estimation and testing according to the features of the error process in that system. In this paper, statistical characteristic of some statistics, such as instantaneous accuracy estimator $\hat{\sigma}_j$ and $\hat{\delta}_j$, accuracy estimator in a short time interval $\hat{\sigma}(j)$ and $\hat{\delta}(j)$, mean accuracy estimator in whole time interval $\hat{m}$ and $\hat{\sigma}$, etc. are analyzed. Their distributions and expectations and variances have been deduced. Moreover, an example is cited to explain the procedure in applying the principle stated above.
This paper was received for publication on 20 Sep 80.

AUTHOR: SHI Kexin [0670 0668 0207]
WAN Bangzhi [8001 6721 1807]

ORG: None

TITLE: "Stiff Optimum Design of Radar Antenna Structures"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 3, Aug 82 pp 47-62

TEXT OF ENGLISH ABSTRACT: This paper presents the concept of stiff optimum design, based on real design requirements of radar antenna structures. An optimality criterion of platetruss composite antenna structures has been developed by using surface accuracy of the antenna as main constraint, both cross-sectional areas of bars and thicknesses of plane stress plates as design variables as well as the weight of the antenna structure as objective function. Through alternatively optimum design, we have obtained an optimal structure which not only meets design requirements but also has the lightest weight. Thus, it is an efficient and convenient approach, which will be extensively used. Through both calculation of two examples and comparison with solutions obtained by common design algorithm, it has been shown that the algorithm has efficiency and utility.
This paper was received for publication on 17 Oct 80.
6248
CSO: 4009/398

AUTHOR: ZHONG Xun [0112 6598]

ORG: None

TITLE: "Vigorous Development of Science Exchange With Organizing of Chinese Language Information Processing Study Group in China"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 8, 1982 p back cover

ABSTRACT: The study of data processing in Chinese characters is a new science, relating to linguistics, computer science and technology because there are thousands of distinct characters. New challenges will appear in the character input into a computer, character printer, computer discrimination of characters, and data processing of characters. The Chinese Language Information Processing Study Group was founded in June 1981 following approval by the China Scientific and Technical Association. The group has an office in the Computer Technology Institute of the Chinese Academy of Sciences. The chairman of the study group is professor Qian Weichang [6929 0251 7022] of the Qinghua University; the secretary general of the group is Yu Kongshi [6079 1313 2514], an associate researcher of the Computer Technology Institute. In August 1983, the study group will sponsor at Beijing a Chinese Language Information Processing International Discussion Conference. Small exhibitions will be displayed at the conference; notifications on conference rules and theses solicitation will be mailed to concerned parties in the immediate future.

10424
CSO: 4009/395

AUTHOR: None

ORG: Shanghai Office, Institute of Power System

TITLE: "Convening of All China Central Heat Supply Science Conference at Beijing"

SOURCE: Shanghai DONGLI GONGCHENG [POWER ENGINEERING] in Chinese No 4, 15 Aug 82 p 51

ABSTRACT: From 5th to 11th May, a Central Heat Supply Science Conference was held at Beijing; the conference was jointly sponsored by the China Mechanical Engineering Society and China Electric Engineering Society. More than 260 delegates took part in the conference. Li Renjun [2621 0086 0193], an advisor to the State Planning Commission, and Huang Yicheng [7806 3015 6134], deputy director of the commission, attended the conference; Huang delivered a scientific report. The conference discussed the five following topics: (1) several approaches to remodeling condenser power systems into heat supply systems; (2) construction of power plants for individual plants and for small- and intermediate-sized areas, as well as power generation with differential pressures; (3) construction of large regional power stations; (4) fundamental theory and selection of equipment for central heat supply systems; and (5) construction of boiler rooms and heat supply piping for central heat supply systems. In addition, discussions were held on heat value, management of central heat supply system, the concept of heat supply in Beijing, and an evaluation of economic effect.

AUTHOR: None

ORG: Shanghai Office, Institute of Power System

TITLE: "Third Nuclear Power Science Conference"

SOURCE: Shanghai DONGLI GONGCHENG [POWER ENGINEERING] in Chinese No 4, 15 Aug 82 p 76

ABSTRACT: From 23 to 26 April 1982, the Third Nuclear Power Science Conference was held at Wuhan; the conference was jointly sponsored by the China Mechanical Engineering Society and Power Engineering Society. This conference was vigorously supported by the Hubei Provincial Mechanical Engineering Society, and was organized by the Wuhan Boiler Plant. Altogether 67 delegates from 33 units took part in the conference; 25 theses were discussed, including safety guidelines and economic analysis in designing nuclear reactor power plants, as well as the evaporator, main pumps, and components in the reactor. The participating delegates engaged in a vigorous discussion of scientific activities for three to five years into the future.

10424
CSO: 4009/394

AUTHOR: XU Ding [1776 7844]

ORG: Beijing Central Design and Research Institute for Nonferrous Metallugical Industry

TITLE: "Surface Hydraulic Mining of Placer in China"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 3, Aug 82 pp 1-7

TEXT OF ENGLISH ABSTRACT: Surface hydraulic mining of placer has been practiced in the People's Republic of China for a long time. The principal mining method employed is: the minerals containing materials are loosened with monitors, lifted with slurry pumps and transported with water through channels under gravity. Much experience has been accumulated through a long period of practice. On the basis of summed-up experience, this paper mainly introduces the successful experience in exploitation, designing, and production in large-scale hydraulic mining of placer. In designing and operation, long distance inverted siphon pipes across vast and deep basins have been successfully adopted so as to make the slurry flow under gravity; long distance channels with minimum slope have been used to ease the flow under gravity. In some mines where caved-in caverns contained relatively large placer reserve exist in the karst bedrock, adits and orepasses have been used for transportation in place of the slurry pump lifting; furthermore, some technical measures, such as the treatment of clay agglomerate formed by rolling during transportation and channels built with high abrasiveproof materials have also been taken.

AUTHOR: XU Kailiang [1776 7030 2733]

ORG: None

TITLE: "Facing Mine Production, Stressing Applied Research: A Brief Introduction of Changsha Mining Research Institute"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 3,Aug 82 pp 71-79

EXCERPT OF ENGLISH ABSTRACT: Changsha Mining Research Institute (CMRI), one of the technical centers especially for comprehensive research on and development of new methods, technology, equipments,and materials for mining metal deposits in China, is situated at the foot of the Yuelu hills along the western bank of the Xiangjiang River, Changsha, Hunan Province. Founded in 1956, CMRI is one of the scientific research organizations directly under the Ministry of Metallurgical Industry, the People's Republic of China. At present, CMRI has nearly 500 scientific and technical persoonel, including over 300 senior engineers and engineers. There are in CMRI 8 research departments, namely, mining methodology, sinking and drifting, loading and hauling, rock mechanics and supporting, drilling tools, blasting technique and materials, rock breaking and drilling machinery, and mining automation and instrumentation, and 10-odd relevant laboratories such as drilling, blas**ting, ore** drawing, filling, rock mechanics, grouting, hydraulic, electric drive, rock breaking, diesel exhaust clearing and electric measurement of nonelectric parameters.

[continuation of YOUSE JINSHU No 3, 1982 pp 71-79]

There are also in its possession a research department of technical information, a central laboratory and a subsidiary processing plant for research and trial-manufacture. The scientific research work of CMRI is specially stressed on the efficient methods of underground mining and advanced construction methods of underground projects especially for metallic ore deposits other than coal fields. For over 20 years since its foundation, 1/3 of the achievements made in completed projects of scientific research have been introduced and applied in mine production and construction, among these over 70 items have been ranked as the significant achievements in science and technology by the government. In addition, a lot of products, instruments, and equipments have passed the state appraisal and have been put into series production.

AUTHOR: CHEN Yujiang [7115 3768 3068]

ORG: None

TITLE: "Huanren Mineral Processing Plant"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 3, Aug 82 pp 80-84

TEXT OF ENGLISH ABSTRACT: Huanren lead and zinc mineral processing plant lies in the hilly country on the Changbai mountain system in the eastern part of Liacning Province. This plant went into operation in 1940, but afterwards its operation was interrupted and production was resumed in 1951; its scale gradually enlarged. At present, 4 kinds of concentrates of copper, lead, zinc, and iron are produced. The deposit belongs to the skarns type and in the deposit there are 2 types of ores: lead-zinc ore and copper-iron ore. The ores contain 0.25 percent Cu, 0.28 Pb, 1.16 Zn; in copper-iron ore, iron content is over 20 percent. The plant includes the following sections: crushing and screening, grinding and classification, flotation, magnetic separation, water supply, dewatering, and tailing disposal. The crushing and screening section is the primary closed circuit flowsheet with 3 stages, the crushing product size being -12mm; the grinding and classifying section is one-stage closed-circuit flowsheet, the classifying overflow containing 40 percent solids, in which -200 mesh accounts for 55-65 percent. The technological flowsheet is gradually getting perfect after modification for several times and has got better metallurgical performances. The original designed flowsheet was the preferential flotation

[continuation of YOUSE JINSHU No 3, 1982 pp 80-84]

of lead-zinc ore; in 1977, the copper-lead bulk flotation flowsheet with the iso-floatable feature was designed due to the increase of the copper content in the ores year by year. Copper-lead bulk flotation was carried out first and then copper-lead ore was separated with sulphite: lead roughing concentrate contained over 20 percent Zn and the zinc removing operation had to be included in the flowsheet, the middling being returned to the mill for regrinding and reagent removing. The obtained results were: copper concentrate grade 28.9 percent, copper recovery 85.6, lead concentrate content 63.4, lead recovery 62.7, zinc concentrate grade 54.5, its recovery 90.8. Magnetite in the flotation tailing is recovered by the use of magnetic separation. Iron concentrate with a grade of 66-68 percent can be obtained by fine screening, regrinding, and two-stage cleanings from roughing concentrate. The plant water comes from Hunjiang and stores in high-position water sump. The final tailing contains 25 percent solids (by weight)and it ispumped to the tailing dam with sand pumps, which can hold tailing for 20-25 years.

AUTHOR: LU Baoyu [7627 1405 3768]

ORG: Hulu Island Zinc Plant

TITLE: "Technical Innovation Highly Valued in Huludao Zinc Plant"

SOURCE: Beijing YOUSE JINSHU [NONFERROUS METALS] in Chinese No 3, Aug 82 pp 85-87

TEXT OF ENGLISH ABSTRACT: In last 3 decades, the production in Huludao Zinc Plant has continuously been developing and the economic benefit has constantly been increasing. In this paper, the experiences gained by the plant in these fields are discussed. The plant has succeeded with the following practices: with the connotation in the lead, paying attention to introducing the advanced technology both from abroad and at home, carrying on unceasing technical innovations, and highly regarding the comprehensive utilization of the resources. LU Baoyu graduated from the Baotou Iron and Steel Institute in Inner Mongolia in 1964. Now, he holds the post of Director and Chief Engineer in Huludao Zinc Plant. He has been engaged in planning and management for many years. He has abundant experience in comprehensive planning and technical management in industrial enterprises. He is enthusiastic in the cause of science and technology in the metallurgical field. He is one of the corresponding members of the editorial committee of this journal, a publication of the Chinese Society of Metals. Furthermore, he is a council member and the head of the Pollution Control Academic Group of the Liaoning Society of Metals, member of

[continuation of YOUSE JINSHU No 3, 1982 pp 85-87]

Liaoning Association of Science and Technology. He has authored following technical articles: "Prospects for Zinc Smelting in Vertical Retorts," "Introduction to Zinc Technology in Huludao Zinc Plant," etc.

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APPLIED SCIENCES

SEISMOLOGIST PREDICTS MAJOR EARTHQUAKE

OW101407 Beijing XINHUA in English 1218 GMT 10 Sep 82

[Text] Beijing, 10 Sep (XINHUA)--Ten indicators suggesting an imminent earthquake have been outlined by Mei Shirong, of the Chinese State Seismological Bureau here today. She was addressing the current international symposium on continental seismicity and earthquake prediction.

The 10 indicators are:

1. Usually before a large earthquake, there are numerous minor tremors that occur from several days to several months before the disturbance. The 1975 Haicheng quake was precedented by 600 tremors in 1 year. However, another entirely opposite indicator is abnormal tranquility, as in the case of the 1976 disastrous Tangshan earthquake, when only three small tremors occurred in 3 months preceding the Knoll taking.

2. There is a growing incidence of faulting of the land.

3. The level of underground water sometimes drops and very often rises again 2 weeks before a major quake.

4. The chemical components of underground water change. There are abnormalities in the content of radon, carbon dioxide and fluoride and chloride ions.

5. The natural electric field in the quake area often registers drastic changes a few days before a major quake. Drops or rises in the earth-resistivity in the place often occur a few days to a few weeks before the quake.

6. There is also a drop in earth's magnetic field 1 to 2 months preceding the quake and a speedy rise again a few days before it.

7. No less than several dozens of kinds of animals tend to display signs of abnormality about a day or so before a quake, and such abnormality reaches a climax about 2 to 3 hours beforehand. This is attributed to the noise of the cracking of underground rocks, undetected by human ears but audible to the animals sensitive hearing, the letting out of hydrogen sulphide gas and the elevation of underground temperature--which very often brings hibernating animals out--and to low-frequency vibration of the air.

8. There is abnormal underground sound which increases in frequency and then suddenly stops just before the quake.

9. A few days before an earthquake the records of many quake detecting instruments often fluctuate greatly in a cyclical way.

10. Because of the abnormal electromagnetic wave, there is radio jamming, especially in short wave radio communications.

After listing these 10 indicators, Mei Shirong said earthquake prediction is such a difficult field that although, generally speaking, these 10 are accurate and helpful, many other factors also complicate the matter. So, she told the symposium, they are only indicators of earthquake possibility and cannot be considered determining factors. She called for further study on physical processes of seismic source and said China still has a long way to go in the field.

CSO: 4010/4

APPLIED SCIENCES

EXPERIENCE IN QUAKE PREDICTION

OW121037 Beijing XINHUA in English 0739 GMT 12 Sep 82

[Text] Beijing, 12 Sep (XINHUA)--The experiences of China's several successful earthquake predictions show that, to a certain extent, earthquake is predictable, said Chen Xinlian, secretary-general of the Chinese Society of Seismology today. He is attending the international symposium on continental seismicity and earthquake prediction now in session in Beijing.

In an interview with XINHUA, he said that earthquakes were predicted successfully in China including the 7.3-magnitude Haicheng earthquake in Liaoning Province, on 4 February 1975; the 7.3-magnitude Longling earthquake in Yunnan on 29 May 1976 and the 7.2-magnitude Songpan earthquake in Sichuan on 16 August 1976.

Professor Chen said, thanks to the accurate time and place predicted and timely anti-quake measures taken, very few people were killed in these shocks, though more than 90 percent of the houses collapsed and farmland destroyed in the epicenter areas. In Longling, over 420,000 houses were ruined, but the number of the killed was less than 0.5 per thousand of the total population in the 1,800-square-kilometer quake-stricken area.

The main indicators prior to the Haicheng earthquake included the increased intensity of small earthquake clusters, and the levelling anomaly, the increase in abnormality of underground water level, animal behaviours, and other signs including geoelectric resistivity and the radon content in water and the foreshocks.

Chen said, in the past 7 years, the Chinese Society of Seismology has organized scientists to reevaluate these indocators and expound them in theory. After much field work in checking, reexamining and analysing, they hold the view that these anomalies regarded as the basis for the prediction of Haicheng earthquake are reliable. With experiment and research on some phenomena, the scientists obtained some helpful conclusions. For example, the coming out of the hibernating snakes is also caused by the overflow of underground gas, not the sole increase of earth temperature.

The seismologists also discovered that prior to Haicheng quake, these anomalies occurred simultaneously over a large area and when these anomalies change they change at the same time.

Although earthquake prediction is still at the probing and research stage, Professor Chen said, by selecting reliable anomalies and studying their occurrence, development and interrelations, earthquake can be predicted to a certain extent by using the comprehensive prediction method.

Through observation and research in the past dozen years, Chinese seismologists have analyzed a number of earthquakes and accumulated experiences. The comprehensive prediction method conforms to China's actual conditions and is of great importance to strong earthquake prediction at the present stage.

Chen Xinlian pointed out that besides the professional observation of seismic activity, crest deformation, underground water, geoelectric resistivity and geomagnetism, another important factor is to popularize seismic knowledge among the people and rally them to set up monitoring points. The people had provided a vast amount of valuable information for the successful earthquake predictions in China, he added.

However, earthquake prediction is a complicated and difficult problem, he said. The international symposium has provided Chinese and foreign seismologists a good opportunity to exchange their experiences and cooperate.

Chinese seismologists, he stated, are willing to contribute their findings for improving earthquake prediction and learn from their foreign counterparts.

CSO: 4010/4

YUNNAN EARTHQUAKE FORECAST CENTER OPERATIONAL

OW101050 Beijing XINHUA in English 0701 GMT 10 Sep 82

[Text] Kunming, 10 Sep (XINHUA)--Though still under construction, an experimental earthquake forecast center in a seismically active area in the western part of Yunnan Province has already begun collecting and processing data through its computer system.

The Dianxi (western Yunnan) Earthquake Forecast Center, which operates under the State Seismological Bureau, is one of the biggest in China, according to a spokesman for the center. Its computer system receives, processes and analyses data from a network of substations now being established in a 40,000 square kilometer area. The region is noted for its complex geological structures and frequent seismic activities, the spokesman said.

The center will mainly engage in research into ways of forecasting earthquakes through seismological observations and simulating tests, the spokesman said. Other subjects of research include deformation of the earth's crust and the theories and techniques of forecasting earthquakes using terrestrial magnetic methods.

The main building of the center and part of the scientific instruments have been put to use, the spokesman said.

The center is open to foreign seismologists, according to the spokesman. The scientists would be happy to cooperate with their foreign colleagues in a variety of fields relating to seismology, right at the center, he added.

China is a seismically active country. The most destructive earthquake in recent years took place on 28 July 1976 in the Tangshan-Fengnan area of Hebei Province, which took 242,000 lives.

CSO: 4010/4

DEVELOPMENTS, ACHIEVEMENTS IN DRILL ENGINEERING REPORTED

Beijing TANKUANG GONGCHENG [PROSPECTING ENGINEERING] in Chinese No 4, 20 Aug 82 pp 2-5

[Article by Geng Ruilun [5105 3843 0243] and Zhou Guorong [0719 0948 2837]: "China's Recent Developments and Major Achievements in Drilling Engineering"]

[Excerpt] Developments and achievements in drill core exploration since the founding of the People's Republic

After the birth of the New China, the party and the people's government have paid extremely important attention to geological mineral exploration. Drill core exploration is a necessary engineering technique for geological ore search and rapid development has been made. Beside geological ore search which uses a small amount of drill core exploration, exploration technology is also widely used in hydrogeology, engineering geology, and engineering construction. Up to now, departments which are equipped with exploration engineering technology already include geology, metallurgy, coal, second machine-building industry, railway, water conservation, electric power, communications, construction materials, chemical engineering, city construction, agriculture and forestry, and national defense construction. The number of core drills in operation in country totals 5,000 to 6,000 units. The cumulative exploration footage has reached about 300 million meters. Large amounts of mineral resources have been prospected for state socialist construction and gigantic contributions have been made in foundation exploration for many water conservation hydroelectric power, railway, communications, and city and national defense construction projects. Looking back to the more than 30 years since liberation, the course of development of drill core exploration not only can be used to compare the new and the old social systems but also should be used to clearly establish the future direction of development as a continuation of the past and on the foundation of achievements already accomplished.

1. From the beginning of liberation to 1952, the country was in a period of economic recovery. Because of the extremely weak foundation in geological exploration work, the work in this period was primarily in the area of establishment. The people's government took over the original Peiping Department of Geological Investigation, Department of Geological Investigation of the Ministry of Economics in Nanking, the Mineral Survey and Exploration Office of the National Resources Commission, as well as the geological investigation departments

and mining organizations of various regions. It also very quickly organized a number [of] exploration teams to implement exploration work. In September 1950, the Commission [or Committee] for the Direction of Geological Work Planning was established, under which the Bureau of Mineral and Geological Exploration was set up to lead the geological work in the entire country. In 1952, the Ministry of Geology was established, under which the Department of Mineral Exploration Engineering was set up, and geological exploration by geological departments was started on a national basis. At the same time, geological exploration work was also started by the coal departments (then the Ministry of Fuel Industries), metallurgical departments (then the Ministry of Heavy Industries), as well as the departments of hydroelectric power and railways. At the beginning of this period, old exploration equipment left by the Old China was used and drilling methods included the use of hard alloy drill bits, iron sand drill bits, and extremely small quantities of diamond drill bits. Later, based on the conditions in the country, Soviet hand-held drills were imported, using primarily hard alloy and iron sand drill bits. This did not compare with the world's advanced standards. For example, the drilling power used--A22 and H22 diesel engines--very quickly became obsolete and were eliminated. Even then, the use of entire Soviet exploration equipment and technology provided the foundation for the establishment of exploration work in our country. During this period, the state also invited a number of Soviet exploration specialists, and schools and training classes for the training of geological exploration technical personnel were started by the geological and metallurgical and coal systems. Large exploration teams were also used to train local technical exploration teams were also used to train local technical exploration workers (such as the then Tongguanshan, Baiyinchang, Daye, Xuanhua, Baiyun, Obo, and Weibei exploration teams).

2. Starting with the First Five-year Plan, development in geological exploration work gradually took place in accordance with the needs for national economic development. The amount of exploration work increased gradually from year to year. By the middle of the Second Five-year Plan of 1960, more than 5,000 core drills were in operation and annual exploration footage was in excess of 10 million meters. During this period, exploration technology involved primarily Soviet equipment and experience. However, the spirit of self-reliance began to be developed. The various areas of production and technical management gradually became normalized, and technical innovation by the masses and new records emerged repeatedly. The Beijing Geological Institute, Beijing Mining Institute, Zhongnan Mining and Metallurgical Institute, as well as local higher and specialized institutions in Changchun and Wuhan began to provide to the society specialized talents in exploration engineering. The Exploration Technology Research Institute was also established in 1957 to specialize in the scientific research of exploration technology. The rate of exploration per drill-month increased to over 270 meters in 1960. In the area of drill core exploration, accomplishment of "Rules of Operation for Exploration"; summary of operating experience in hard alloy drilling and iron sand drilling; advanced exploration records achieved by the Zhongnan 404 team and the Ximeng team of Neimeng [Inner Mongolia]; wide attention to slurry hole protection; initial adoption of coreless drilling in accordance with local conditions and creation of a set of scrapper drill bits; successful innovation of a number of mechanized tools for raising and lowering operations, such as the column type pipe moving and placing

installation, Guanmenshan type lifter, Tangshan type and Liaoning type pipe twisters, etc; initial adoption of hydraulic pressure vertical axle type drills (3ud -300, 3ud-650, 3ud-1200) and the conversion of the original KAM model hand-held drill to advancement with hand wheels and rod inversion without stopping drill; etc. These accomplishments and experiences had an important effect at the time in maintaining the continuous improvement of efficiency of exploration production and in reducing the labor intensity of the workers. The practical significance of the same experiences remains even today. Those in scientific research worth mentioning are; start of air cleaning of wells, analysis of drilling mud-making (bentonite), instrument for inclination survey, core recovery in complicated rock formations and the study of classification of rock drillability and hole bottom electric drilling.

3. From after the second year of the Second Five-year Plan to 1976, the country was in its 3 years of economic adjustment and the turmoil of the 10 years of "Cultural Revolution." During this period, the national economic development was greatly affected. However, with efforts exerted by the large geological ore search staff and workers and their self-reliance and hard struggle, some progress was still achieved in exploration work. This is concretely reflected in the following areas:

(1) Domestic design and manufacture of exploration equipment and instruments

The drills designed and manufactured included 100-meter, 300-meter, 600-meter, and 1,000-meter depth capability hydraulic pressure vertical axle type drills of the geological system [refers to organizations under the geological system], model Beijing-500 rotary table type drill of the metallurgical system, models TXU-700 and 1,000 drills of the coal system, as well as SPC-300, SPJ-300, and Red Star 300 drills used for hydrology and water wells, model SH-30 drill used for the exploration of engineering foundation, and large diameter concealed-hole vibrating rotary drill, etc. At the same time, drill towers and mud pumps used with the above drills were also designed and manufactured. Inclinometers that could be used in both non-magnetic and magnetic mineral areas were also designed and manufactured. As a result of this work, the past situation of primarily relying on imported exploration equipment has come to an end.

(2) Taking hold of the manufacturing technology of diamond drill bits

At the beginning of the 1960's, the Exploration Technology Research Institute of the Ministry of Geology and the Zhuzhou Hard Alloy Plant cooperated in the study and manufacture of diamond drill bits. By 1963, surface impregnated natural diamond drill bits were successfully manufactured using cold pressure soaking and sintering method. This was the beginning of diamond drill bit manufacturing and the use of diamond bits for drilling in our country. Around 1970, the Ministry of Metallurgy and the Institute of Physics of the Chinese Academy of Sciences first called for and started the experimental research of artificial diamond drilling. This had an important effect in pushing forward the development of diamond drilling in our country. In 1974, a technical exchange conference on artificial diamond drilling was held at Xikuangshan in Hunan. At the same time, appraisals were made of artificial diamond drill bits originally used in the drilling of tunnels and developed and manufactured by

the Geological Research Institute of the Ministry of Metallurgy, Beijing Powder Metallurgy Research Institute, Lanzhou Petroleum Equipment Research Institute, Exploration Technology Research Institute of the Ministry of Geology, and the Shanghai Grinding Wheel Plant. Thereafter, continued improvements were achieved in the manufacturing technology of diamond drill bits and reamers, and the use of artificial diamond bits was applied to drill core exploration on the ground surface.

(3) High strength pipe materials for geological work researched and manufactured

Up to the end of the 1960's, the steel pipes used for geological exploration had always been imitations of the Soviet Union and adopted the use of large quantities of drill rods, casings, and core pipes made with No "45" steel (equivalent to No 45 steel). The tensile strength was 65 kilograms per square millimeter and the yield strength was 38 kilograms per square millimeter. Friction losses were rapid and accidents due to breakage were numerous drilling. And the requirements for diamond drilling were not met. Under the direction of the Bureau of Standards of the Ministry of Metallurgy and jointly with the users, the steel pipe standards "YB235-63" and "YB235-70" meeting the requirements of hard alloy--steel pellet drilling for geological exploration and the steel pipe standard "YB848-75" meeting the requirements of small diameter diamond drilling were established. Beside improvements in sizes, the use of No "45" steel, employed originally, was abandoned in the latter two standards, and the use of maganese, molybdenum, vanadium, titanium, and boron-bearing low alloy steel elements of which our country has rich resources, was adopted. The lower limit of yield strength was established at 50 kilograms per square milimeter. The requirement for drill rods and core pipes was set at 65 kilograms per square millimeter.

(4) Improvements in drilling techniques

In order to guarantee the engineering quality of exploration, the broad masses of technical exploration personnel and workers have created many types of core recovery tools of special characteristics. These core recovery tools have totalled as many as 50 types in 6 categories, namely single pipe core recovery drill, double action double pipe drill, single action double pipe drill, anti-circulatim drill, core recovery drill for diamond drilling, and mineral core recovery support tool. As a result, the core recovery quality in exploration has been guaranteed to a very major degree for many of the minerals for which core recovery is difficult, including phospherous, sulfur, graphite, mica, mercury, asbestos, talc, loose and soft coal formations, and various types of hard, brittle, and broken mineral formations.

Diamond drilling requires high rotational velocity. To meet this requirement, the metallurgical and geological systems and related institutes and universities and plants have successfully experimented with the production of saponified oil, Archaean oil, (sulphonated neat's foot oil), No 126 emulsion lubricant, and lubricating grease, etc. Under general conditions, the drill rotational velocities are able to satisfy the advancing rate of diamond impregnated drill bits in 600- to 800-meter and even 1,000-meter deep holes. This accomplishment has created the conditions and opened up the situation for the use of diamond impregnated drill bits for exploration drilling on the ground surface.

Another improvement of technique is the use of light, nondispersion, low temperature solid phase drilling mud. High quality (bentonite) powder is used for drilling mud and polymerized propylene acyl amine high molecular polymer has been studied for the preparation of drilling mud. The Exploration Technolgoy Research Institute and the Red Flag Chemical Plant of Mudanjiang were successful in the research of iron chromium lignin sulphonate, which has filled a bland in our country's mud treatment agent.

(5) Adoption of many types of drilling methods

At the beginning, coreless drilling was practised depending on local conditions. Because of the successful adoption of coreless drilling by the coal departments, vast improvements in the efficiency of coreless exploration drilling were achieved and the drill-month rate always topped others in the country. The Exploration Company for the Liaoning coal field established the annual record for a single drill of 20,000 meters.

In impact rotary drilling, the Exploration Technology Research Institute had at one time started research and production experiments before 1966. Later, systems under the Second Ministry of Machine-Building Industry along with the Bureau of Geology of Liaoning Province and the Geological Institute of Changchun conducted numerous experiments. Beside the use of valve type impacters, jet type impacters were created. This established a foundation for the use of the impact rotary technique in our country.

Directional drilling has been adopted in a number of mining regions in Yunnan, Sichuan, Guangdong, Heilongjiang, Shaanxi, and Hunan. One type is the use of natural curves to drill directional holes. The other is the use of incline guides and artificial curves to drill directional holes. Although directional drilling techniques and equipment are not yet perfected, actual experience has proved the economic benefits of directional drilling in some of the mining regions. For example, engineering quality of exploration and smooth progress of exploration work have been guaranteed, the volume of exploration work conserved, rejected work projects avoided or reduced, and exploration period reduced.

Cable core-recovery drilling has begun to be experiemnted with by the geological, metallurgical, and coal systems. Technical appraisal is being carried out on the S-56 drill.

In addition, research and experimentation have been conducted on the hole bottom electric drill and the turbine drill. On behalf of the coal departments, the Exploration Technology Research Institute has used the ϕ168 electric drill and has experimented successfully with drilling of frozen holes requiring a high degree of perpendicality. The Second Machine-Building system has carried out production type experiments with its small diameter turbine drill.

4. In the more than 5 years since 1977, in order to satisfy the needs of four modernizations for geological mineral production, the party and the state have shown great concern for the development and improvement of geological exploration work. The various related geological exploration departments have placed

their efforts toward improving the engineering quality and production efficiency of exploration, improving the coordination between exploration equipment and its supporting instrumentation as well as their technical properties, and at the same time improving the labor protective conditions of the onsite operating personnel. The diamond drilling experience exchange conference conducted in Guilin in the spring of 1977 by the three ministries and one bureau (Ministry of Coal Industry, Ministry of Metallurgy, Second Ministry of Machine-Building Industry, and the Bureau of Geology of the State Planning Commission) and the Second National Exploration Engineering Academic Conference conducted in Beidaihe in November 1979 not only engaged in the exchange of experiences in the accomplishments achieved in past exploration work, but at the same time also explored existing gaps in exploration work. Through specialized inspections and technical meetings abroad in recent years, the direction has been further clarified on how to absorb advanced foreign experiences and carry out the modernization of our country's exploration engineering based on our own conditions. In the area of drill core exploration, the exploration sector commonly believes that the primary emphasis should be in gradually expanding hard alloy and diamond drilling while, at the same time, important attention should be given to the many types of methods and techniques of impact rotary drilling, coreless drilling, core drilling without lifting the drill, directional drilling, and drilling with air cleaning of wells. Even greater attention should be paid to the application and research of new types of mud in drilling and in wall protection and the stopping of leaks. Drilling and core recovery techniques in certain complicated rock and mineral beds should be mastered. A firm hold should be made on deep hole drilling techniques of 2,000 to 3,000 meters which are needed for the reasearch of geology at depth. For the development of hydrogeology and engineering geology, skills and technology for hydrological and water well exploration and for engineering geology exploration should be vigorously improved (especially for large diameter drill holes). In exploration equipment, instruments, and tools, efforts must be made to gradually achieve standardization, systematization, and interchangeability. In the systematization of drill tools, rational standards should be studied and established while paying attention to coordination with common international standards at the same time. And, in order to reach these goals, very serious attention must be given to the education and training of technical personnel and to scientific research work, and mass technical innovation movements should be launched and developed.

Through their efforts in the last 5 years, the various related research institutes and universities and geological exploration departments have achieved gratifying results in the above described areas. As a result, notable improvements have been made in our country's exploration technology and production level. These improvements together with earlier achievements after the founding of the People's Republic have given us a new look. Our current levels in this field are:

(1) Diamond drilling has been widely promoted. The ratio of diamond drilling in the various departments is now between 10 to 30 percent. In 1981, more than 600 diamond drills were in operation in the country. The drill-month rate of diamond drilling now averages 350 to 500 meters for the entire country, with manu units achieving rates of over 600 meters. Some departments plan to basically eliminate steel pellet drilling by 1985.

(2) Manufacturing techniques of various types of diamond drill bits are already under control. These include the cold pressure method, soaking method, hot pressure method, and electroplating method, etc. The properties and quality of drill bits have been continuously improved and varieties of drill bits have been continuously improved and varieties of drill bits gradually increased. The average life of diamond drill bits in the country is now 35 to 40 meters of drilling. In limestone and gneiss, the average life in many instances exceeds 100 meters. Diamond drill bits have begun to be exported.

(3) Single crystal quality and quantity of artificial diamonds produced already are able to satisfy the needs of diamond drilling in the country. Various types of polycrystals, surface impregnated drill bits have shown very good results when used in medium and hard rock formations. Research in the manufacture of composite [flakes] is actively moving forward.

(4) Cable core recovery drilling is being expanded. Currently, about 70 cable core recovery drills are in operation. Total footage drilled with these drills is over 100,000 meters with very good technical and economic results. The diameters of existing drills are 46, 56, 60 and 76 [no unit given!]. Compared to common core recovery methods, drilling time and drill-month efficiency can both be improved by about 25 to 30 percent, drill bit life is increased by 25 to 50 percent, and both rock and mineral core recovery rates are above 90 percent. Using cable core recovery, record depths of holes of 2,370 meters, 1,896 meters, and 1,500 meters have been established by the geological, coal, and metallurgical systems respectively. Some difficult problems of evaluating geological minerals at depth have been solved.

(5) Hydraulic impact rotary drilling is gradually being development and improved. The departments of the Ministry of Second Machine-Building Industry, Ministry of Geology, and Ministry of Metallurgy have used various types of hydraulic impacters in recent years (including Models JSC-75, YE-2, YC-75, and 726 and various types of jet and valve impacters). Over 100,000 meters have been drilled. Relatively good results have been achieved in Classes 7 and 8 and some Class 9 rock formations. The deepest hole exceeded 600 meters. High frequency diamond impact rotary drilling is in the experimental stage. There is hope that results can be achieved in hard, (smooth) formations.

(6) Development in engineering geology exploration has been very rapid. It is widely used in railway, communications, bridge foundations, water conservation and hydroelectric dams, harbors, air fields, subways, and warehouses and tall urban building foundations, and foundation pilings. Currently, about 2,000 engineering drills are in operation in the country. In past years, they were used in such large scale foundation exploration tasks as the foundations for the Yangtze Bridge in Wuhan, Yangtze Bridge in Chongqing (using 3-meter diameter gear wheel drill), and the hydroelectric projects of Gezhouba of Yangtze River, Longyangxia of Huang He, Liujiaxia, and Gongju of Dadu He. Some of the drill hole recovered cores were 1 meter in diameter.

(7) Technology for hydrological and water well exploration and geothermal exploration (including thermowater wells) has been continuously improved. Nearly 1,000 hydrological and water well drills are in operation in the country. The

figure is more impressive when the number of units for well drilling in local urban and rural areas is added. The current development is towards deeper and larger diameter wells. For example, deep water wells of over 500 millimeters in diameter and 500 meters in depth have already been drilled in Xian. The wells completed in the Beijing-Tienjin area have depths of 800 to 1,200 meters and some even over 2,000 meters. In the high-temperature steam geothermal drilling of the Yangba well in Xizang, the technical problems involved were great and numerous. With the help of engineering technical personnel from the Exploration Technology Research Institute, the earth formation pressure gradient of the thermal field was finally understood, gushing from the well was placed under control, and meaningful results were achieved.

(8) Superior drilling mud has been vigorously promoted. In addition to emphasizing the selection of superior [bentonite] for making drilling mud and the use of low solid phase mud, the use of high molecular polymer mud of propylene acyl amine and other compounds is being widely promoted. Potassium treated mud, frothed mud, and salt solution mud are also adopted on the basis of the special properties of the earth formations. At the same time, cement is being rationally used to geologically seal leaks and casings and to protect drill holes, and many complicated formations have been surmounted.

(9) Directional drilling is being positively adopted. Because of difficulties of preventing the slanting of drill holes caused by geological factors, the geological goal can only be achieved by directional drilling. The departments of metallurgy and geology have already started the development of moving gradually from an initial level of determining directional holes [utilizing the law of slanting of holes (TN: probably referring to making compensations)] to artificial control of directional drilling. Initial results ahve been achieved in experiments using bottom rock cores to determine directions.

(10) Assembly of exploration equipment, instrument, and drill tool components are being perfected. A series of core drills for exploration to depth of 100, 300, 600, 1,000, and 1,500 meters are available. Also available are 100-meter tunnel drill as well as new models of 600-meter and 1,000-meter hydraulically driven powered bit drills. Also available are broken down and car mounted engineering drills for drilling depths of 30, 50 and 100 meters, large diameter hydrological and water well drills for drilling depths of 200, 300 and 500 meters, and 0.3- to 1.5-meter diameter hole engineering construction drills. Also available are mud pumps, moving equipment, and drill towers for above types of drills, a set of exploration parameter instrumentation and mud testing instruments, and several types of inclinometers. Pipe standards are already available to be used, but preparations are being made for their revision. Standards will soon be established for various types of core recovery tools.

(11) Academic movements are very active. Since its establishment on 2 April 1964, the Special Exploration Engineering Committee of the Geological Society has staged two national academic conferences for exploration engineering, one in 1965 and the other in 1979. To meet the needs of exploration engineering development, the society conducted in 1981 a thesis report and discussion conference on four special subjects (cable core recovery, impact rotary drilling, tunnel exploration technology, and exploration instrumentation). This conference had a positive effect for the exchange of experiences and for pushing forward the development of exploration engineering technology. Currently, more than 20 provincial, municipal, and autonomous region geological societies

have established special exploration engineering committees, and local academic movements have been actively organized.

Reviewing the development and major accomplishments of exploration engineering in our country since the beginning of the century, we can see clearly that the exploration capabilities during the more than 40 years before the establishment of New China were very weak. Total exploration during that period is estimated at approximately 700,000 meters. During the more than 32 years after the establishment of New China, exploration work has totalled roughly 300 million meters. Nearly 20 departments of the state now have exploration engineering technology capabilities. About 6,000 drills are in operation in the country. Under the leadership of the Chinese Communist Party, the large exploration staff and workers have moved to work in different parts of the fatherland over the years. They have found large quantities of energy resources, minerals, construction materials, chemical raw materials, and underground water resources for the construction of socialism for the state, and have conducted basic investigations and engineering constructions for many water conservation, hydroelectric, road, bridge, harbor, and large building projects. During this celebration of the 60th anniversary of the Chinese Geological Society. The large workers, cadres, and technical personnel of the country's exploration engineering sector are even more full of confidence and, on the basis of the results already achieved, should locate where the gaps are and really work hard in order to produce new results for the continuous improvements of exploration engineering technology and techniques and production level, and for the four modernizations of the fatherland.

5974
CSO: 4008/223

BRIEFS

CHINESE CHARACTER MICROCOMPUTER--Beijing, 24 Sep (XINHUA)--China has developed a microcomputer for processing Chinese characters, according to the Ministry of Electronics Industry. Designed on a modular structure, the newly developed microcomputer, ZD-2000, consists of a controller, a visual display, a floppy disc for storage, a Chinese character keyboard and an English keyboard. The computer can be utilized in drafting compositions and documents, enterprise management and processing information. The functions of the computer include insertion, deletion and correction of character and typesetting. The ZD-2000 computer can also be connected with other computers to form a large, Chinese character information processing system. [Text] [Beijing XINHUA in English 0749 GMT 24 Sep 82]

CSO: 4010/1

LIFE SCIENCES

REPORTER TALKS WITH CUI YUELI, MINISTER OF PUBLIC HEALTH

Beijing JIANKANG BAO in Chinese 29 Aug 82 p 1

[Report on interview with Cui Yueli, minister of public health, by JIANKANG BAO reported, on the eve of the opening of the 12th Party Congress; place not specified]

[Text] On the eve of the opening of the party's 12th congress, Cui Yueli, minister of public health, spoke to a reporter of this newspaper saying that since the Third Plenary Session of the 11th Party Congress, the various ranks in the public health departments have paid attention to overcoming the influence of leftism in their work carrying out the policies of the party, implementing the readjustment objectives, and emphasizing the function of young intellectuals. Some new progress has, therefore, been made in such aspects as prevention and control, medical treatment, Chinese traditional medicine, scientific research, education, and planned parenthood. Through the movement of "5-lectures and 4-beautifications" the attitude of service has been further improved to raise the quality of disease prevention and control as well as the level of health of the people.

Comrade Cui Yueli said: "Due to the fact that prevention and control have continued to be the goal for several years, a patriotic hygiene movement has strengthened the work of public health and epidemic prevention so that the incidence of some diseases has been further reduced. Comparing 1981 with 1978, the incidence of diphtheria, epidemic encephalomeningitis, pertussis, scarlet fever, and 12 other acute infectious diseases has been decreasing in various degrees. Now, about 95 percent of the inhabitants of regions of endemic thyroidian are taking iodized salt, and a large number of patients have been cured of it. In the prevention and control of schistosomiasis, such comprehensive measures as snail extermination and sewage management, etc., have been adopted. New achievements have been obtained in that field also; 1.04 million victims of that parasitism have been cured.

With regard to medical treatment in rural villages, Cui Yueli said that with the extension and perfection of the system of responsibility of agricultural production, the medical and public health organizations of production brigades have taken on many forms to suit the locality so as to mobilize the positiveness of all sectors. As a result, the 610,000 brigade public health centers and the 1.3 million barefoot doctor teams are stabilized and developed so that

the rural villages all over the country are basically provided with medicine and drugs and have persons to do the work of prevention, control, and planned parenthood.

In order to carry public health work to the rural villages, public health organizations of the county level and below in the entire country have been built up as key points beginning in 1979. In these 3 years, the public health organizations of 300 counties have been reorganized. After the consolidation, the number of leaders and professional staff has been raised from 50 to 70 percent and technical training has started for 40-50 percent of the employees. Consequently, the level of medicine, the level of management, and the quality of service of these key counties have all been greatly improved.

Cui Yueli pointed out that while strengthening the Chinese traditional medical organizations and building up the Chinese traditional medical teams, the emphasis has been placed on maintaining and developing the special characteristic of Chinese traditional medicine so that the work of inheriting, exploring, and improving Chinese traditional medicine and pharmacology may succeed. Now, nationally 781 Chinese traditional hospitals have been established, an increase of 74 percent over those of 1978; Chinese traditional medical teams have been developed to include 289,000 persons, an increase of 15 percent over those of 1978.

Cui Yueli said: "With respect to scientific research, 1,459 items resulting from research have been reported in the various provinces, cities, and autonomous regions in the past few years and 175 of these have been approved at the ministerial level." Some of these research accomplishments have relatively great scientific and economic values. For example, afetal protein general survey has become an effective technique now for detecting early stage liver cancer when there are still no symptoms or physical signs. This technique was first discovered in China. The new antimalarial drug, Qinggaosu [essence of Arthemisia apiacea, Hce.] isolated from the Chinese traditional medical herb has the merits of being fast, effective, and less toxic compared with the drugs currently being used to treat malaria. The semisynthesized Isoharringtonine [from Cephalotaxus fortunei Hook, t; or C. harringtonia var.], first successfully produced in China, is a new drug for treating acute nonlymphatic leukemia and places China in a pioneering position in the world. Treatment of infected open fracture of the bone with integrated Chinese and Western medicine has enabled many would-be amputation patients to preserve their limbs and to avoid the pain of being disabled.

Since the third Plenary Session of the congress, the development of China's medical education has also been relatively fast. At present, the country has 112 medical schools of higher education, having added 14 since 1978. These schools have 170,000 students. There are 556 middle level schools of public health, an increase of 36 over those of 1978. In these 3 years, efforts have also been exerted in the field of continuous education for the employees and a total of 800,000 persons have received such training, amounting to 23 percent of the existing public health personnel.

Cui Yueli pointed out that planned parenthood is China's basic national policy. Public health departments have always regarded the technical work of developing birth control to be an important task. At present, more than 20 million abortions are performed every year, and many advanced units and individuals having performed 1,000 to 2,000 abortions without an accident have emerged. They have contributed to the effective control of population increase. Cui Yueli said that the public health departments of all grades are making the construction of the socialist spiritual civilization their own essential work. Through the activities of "5-lectures and 4-beautifications" the public health work has been forcefully propelled forward and many local public health units have taken on a fresh new appearance. All the hospitals have developed the education of medical ethics, formulated rules of behavior, and established a system of job responsibility. There is also a movement of "If I were a patient" to discuss and to choose superior nurses. Very good results have been obtained.

Finally Cui Yueli also said that although some accomplishments have been obtained in public health work in these few years, there is still some distance to meeting the needs of four modernizations construction. Under the encouragement of the spirit of the 12th party congress, all are to double their efforts to work hard for the prosperity of the fatherland, the still faster development of public health affairs, and offering new and greater contributions to improve the health of the masses.

6248
CSO: 4008/227

AUTHOR: LYU Canren [0712 3503 0088]

ORG: Hot Work Teaching and Research Office, Energy Source Research Office, Tianjin University

TITLE: "Power Analysis of Hot Water Type Geothermal Electrical Power Station and Power Economics of Residual Heat Utilization"

SOURCE: Beijing QUANGUO DIRE XUESHU HUIYI LUNWEN XUANJI [SYMPOSIUM ON GEOTHERMICS OF CHINA, SELECTED WORKS] in Chinese Oct 81 pp 146-158

ABSTRACT: The temperature of the hot water type geothermal resources is below 300°C and on the basis of development difficulties and power utilization, it is further divided into the 3 classes of the high temperature of >150°C, medium temperature of 90-150°C, and low temperature of 50-90°C. In China, due to the level of prospecting and mining, the group of established experimental geothermal power stations all belong to the medium-low temperature type. Their power rating is not high. There is a need for evaluating the economics, the function, and the meaning of developing this type of station as well as for analyses and investigation of the proper techques and policies concerning their development. This paper is an attempt of using the law of thermodynamics to analyze the quality and quantity of heat, to discuss the power economic indices of geothermal power stations, and to determine the effect of major temperature variation on usable energy. Through concrete computation, analysis, and comparison of the data of a low boiling point experimental geothermal power station in China, some viewpoints on the importance of comprehensive utilization of low-medium geothermal power stations are proposed.

AUTHOR: WU Zhijian [0702 3112 1017]
LI Songzhe [2621 7313 0772]

ORG: Both of Guangzhou Energy Source Research Institute, Chinese Academy of Sciences

TITLE: "Determination of Optimal Parameters of Geothermal Power Generation of the Multi-stage Flash Steam System"

SOURCE: Beijing QUANGUO DIRE XUESHU HUIYI LUNWEN XUANJI [SYMPOSIUM ON GEOTHERMICS OF CHINA, SELECTED WORKS] in Chinese Oct 81 pp 159-168

ABSTRACT: Most of the geothermal resources that have been developed in China belong to the hot water type. From the power generation angle, this is a low grade energy source. If this type of geothermal energy is to be economically and effectively utilized to generate electricity, a reasonable thermodynamic system must be selected according to the actual condition of the resource for designing the needed equipment correctly. The multi-stage flash steam system is one way to achieve reasonable utilization but the first task is to determine the optimal parameters to cause the equipment to possess the highest electricity generating power. The evaporation temperature (or pressure) and the condensation pressure (or temperature) are the most influential parameters because they affect the output, the plant use of power, and the equipment size of the power station. There are existing theoretical equations for computing these parameters but they produce only the most ideal parameters and cannot be used to calculate the actual optimal parameters under the condition of pipe resistance and power use at the plant. If the comparative method is used, a great

[continuation of QUANGUO DIRE XUESHU HUIYI LUNWEN XUANJI Oct 81 pp 159-168]

deal of work is required. For the purpose of simplifying engineering computation, the paper adopts a new multi-stage flash steam parallel equivalent system, using the stage by stage cumulative technique to determine the optimal evaporation temperature and condensation pressure under the condition of having pipe resistance and plant use of power. General purpose line diagrams of single stage and multi-stage flash steam are provided.

AUTHOR: WEI Qun [7614 5028]

ORG: Huitang Geothermal Group, Hunan Provincial Research Institute of Technological Physics

TITLE: "Equipment Design of Expansion Geothermal Power Station"

SOURCE: Beijing QUANGUO DIRE XUESHU HUIYI LUNWEN XUANJI [SYMPOSIUM ON GEOTHERMICS OF CHINA, SELECTED WORKS] in Chinese Oct 81 pp 169-175

ABSTRACT: Using the Huitang Geothermal Experimental Station of Hunan Province as the example, this paper introduces the equipment design characteristic and the operation condition of expansion method power generation using medium-low hot water. The mechanism and prospect of geothermal hot water expansion power generation are discussed. The designing and experimentation of the key equipment - the expansion chamber are analyzed and discussed. The Huitang Station is currently in the transitional period of advancing from an experimental station to a power production station as its equipment is being perfected. After power generation, the leftover water may be used to irrigate 800 mu of fields. The hot water after expansion is supplied to the Academy of Agricultural Sciences for rice breeding, medical therapy, fish culture, and meat processing, as well as to the public bathhouse. In these 5 years, the communes and the local masses have welcomed the project.

6248
CSO: 4009/337

AUTHOR: JIANG Jigang [3068 4949 4854]
ZHANG Qian [1728 6197]

ORG: JIANG of the Scientific Research Institute of Petroleum Exploration and Development, Petroleum Administration of Jianghan; ZHANG of Lanzhou Geological Institute, Chinese Academy of Sciences

TITLE: "The Generation and Evolution of Petroleum of the Saline Qianjiang Formation in Jianghan Basin"

SOURCE: Jiangling SHIYOU YU TIANRANQI DIZHI [OIL AND GAS GEOLOGY] in Chinese Vol 3 No 1, Mar 82 pp 1-15

TEXT OF ENGLISH ABSTRACT: Tertiary Qianjiang formation is rich in gypsum and salt. The content of chlorine ions in argillites is 0.1 - 1.5 percent, the average content of organic carbon and hydrocarbon is 0.61 percent, 996 ppm respectively. The kerogen in the Qianjiang formation is of a mixed type with a higher genetic potential for petroleum.

The normal-paraffins of source rocks from the Qianjiang formation mostly fall in the C_{22}-C_{34} range, and show a distinct even-odd predominance with OEP values from <1 to 1 approximately. During the deposition of this formation, in part of the fringing areas where the sedimentary layers have relatively normal water salinity, the normal-paraffins also show an odd-even predominance with OEP values from >1 to

[Continuation of SHIYOU YU TIANRANQI DIZHI Vol 3 No 1, Mar 82 pp 1-15]

1 approximately. These two predominances correspond to each other, but the former is the major one. Therefore, the authors consider the even-odd predominance to be the main path of the hydrocarbon evolution in source rocks of salt lake facies.

Among the isoprenoid alkanes in source rocks of the Qianjiang formation, phytanes are predominant with pristane-phytane ratios (pr/ph) < 1.

Because of the well-developed gypsum and salt and the lower geothermal gradient (2.3 - 3.0°C/100 m) in the Jianghan basin, the evolution rate is slower and the buried depth is deeper than that of the organic matter in common continental source rocks. In the Qianjiang formation, the petroleum generation peak is 3700 m and the lower limit of liquid petroleum generation is 4600 m. Therefore the thickness of the liquid window of hydrocarbon can be up to 2600 m.

The crude oil in the Qianjiang formation can be classified into low-matured oil and matured oil. Its maturity is basically coincident with the maturity of source rocks, which reflects its features of proximity to oil source, short-distance migration and which shows that oil is generated from and reservoired in the Qianjiang formation itself.

AUTHOR: BEI Feng [6296 6265]

ORG: Chengdu College of Geology

TITLE: "A Study on Organic Matter and the Evaluation of Petroleum Generation Potential of Upper Triassic Maantang Formation and Xiaotangzi Formation in Northwestern Sichuan"

SOURCE: Jiangling SHIYOU YU TIANRANQI DIZHI [OIL AND GAS GEOLOGY] in Chinese Vol 3 No 1, Mar 82 pp 67-74

TEXT OF ENGLISH ABSTRACT: The Maantang formation is made of marine limestone, artillite and siltstone, while the Xiaotangzi formation is mainly composed of delta-front deposit of the transition zone from sea to land and is rich is marine and terrigenous plant fossils. In the past, they were considered major source beds in northwestern Sichuan. On the basis of analyses by various modern apparatus, the author studied the geochemical features of kerogen in these two formations. We concluded that both of the formations have been hydrocarbon-generating, but neither of them is a good source rock. If comparing the two, the Maantang formation is better than the Xiaotangzi formation.

AUTHOR: ZHAO Bai [6392 4101]

ORG: The Petroleum Administration of Xinjiang

TITLE: "The Prospects of Petroleum Exploration of Permo-Carboniferous in Junggar Basin"

SOURCE: Jiangling SHIYOU YU TIANRANQI DIZHI [OIL AND GAS GEOLOGY] in Chinese Vol 3 No 1, Mar 82 pp 75-80

TEXT OF ENGLISH ABSTRACT: Junggar is a huge faulted basin and is covered by sedimentary rocks, constituting about 130,000 km^2. The Middle and Upper Carboniferous, the Permian, and the complete Meso-Cenozoic sediments are developed on the Variscian folded basement. The Middle and Upper Carboniferous are marine, transitional and continental deposits. The Permian belong to continental deposits. Both of them are multi-depocenter clastic rocks with abundant organic matter. According to the main geochemical indexes of petroleum generation, they should be the main source rocks in this basin. During the Meso-Cenozoic, the southern part of the basin developed into a deep depression, while the northern part gradually became a southtilting slope. So it is most favorable for the Permo-Carboniferous hydrocarbons to migrate and accumulate toward the northern marginal zone in which the prospecting for oil would be more effective.

AUTHOR: ZHANG Yonghong [1728 3057 7703]

ORG: Jiangsu Brigade of Petroleum Geology

TITLE: "A Preliminary Study of the Prospects of Coal-formed Gas in Carboniferous-Permian System in Xu-Huai Region"

SOURCE: Jiangling SHIYOU YU TIANRANQI DIZHI [OIL AND GAS GEOLOGY] in Chinese Vol 3 No 1, Mar 82 pp 57-66

TEXT OF ENGLISH ABSTRACT: The Xuzhou-Huaibei-Huainan region is one of the major coal industry bases in China. Around it are Mesozoic-Cenozoic overlapping basins of Zhoukou, Huangkou, Hefei, etc., which are the major prospective areas for exploring the natural gas formed by the metamorphism of coal-bearing formations.

The Carboniferous-Permian coal seams within this region are about 5-30 m in thickness, with sufficient gas source. In the step-faulted zone in the eastern Zhoukou basin and the deep-seated areas in both the east and west ends of the Huainan syclinorium, the source rocks of gas are well developed. During its deep-buried process the regenerated gas was also formed. Additionally there exist anticline structures and other types of traps, so this region is the main accumulation area of coal-formed gas, and a major prospective area for exploration. Deep segs in the central basin are places to search for overpressured gas.

9717
CSO: 4009/327

AUTHOR: GAO Jianian [7559 0857 1628]

ORG: Research Institute of Metals and Chemistry, Academy of Railway Research

TITLE: "Current Situation and Outlook in the Study of Wheel and Rail Steels"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 8, Aug 82 pp 66-70, 54

ABSTRACT: The condition of research in wheel steel is discussed in terms of the stress systems of interactions between the wheel and the steel rail, between the wheel and the brake shoe and the problems of deformation such as abrasion, peeling, and heat injuries. The basic condition of development of steel rails in China is divided into the 3 stages of the production of common carbon steel rails, concentrating on the problems of wear and compression resistance, and continuous study on the problems of wear resistance and starting to resolve the problem of fatigue fracture. At present, the outstanding problems are: (1) Wear and contact fatigue; (2) Scraping injury; (3) Fracture of screw holes; (4) Wave abrasion. It may be said; therefore, that the direction of research, beyond the requirement of wear-resistance, should also include such properties as resisting fatigue, cracking, heat injury, and scraping injury. While developing seamless rails, good welding property remains desirable. The paper also includes a brief review of foreign studies on steel materials and a general description of the progress and problems of the development of rail steel in China.

AUTHOR: None

ORG: None

TITLE: "Conference on Energy Conservation in the Steel Rolling Process"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 8, Aug 82 p 78

ABSTRACT: The Second Conference on Energy Conservation in the Steel Rolling Process of the China Society of Metals was held in Guangzhou on 18-23 May 82. Participants included 66 delegates of 46 organizations, including various steel rolling mills, colleges, and scientific research and designing departments. Related scientists of China Society of Metals, the Energy Resources Office of Ministry of Metallurgy, Societies of Metals of Guangdong Province, Hubei Province, Liaoning Province, and Shanghai, and Bureaus of Metallurgy of Shanghai and Guangzhou also attended. The conference received 36 papers and 14 were read. Following discussions on the situation, direction of development, and existing problems with respect to energy conservation, the delegates believed that comparing 1981 with 1980, the annual rate of reduction of heat energy consumption of 5 percent represented the effectiveness of energy conservation measures. Moreover, there have also been progresses in replacing oil with coal, using local materials, enlarging the source of fuel, etc. A continuation of propaganda for energy conservation, strengthening scientific management, and cooperative research on certain worthwhile energy conserving items were suggested. The delegates were organized to tour the Guangzhou Steel Rolling Mill and the Guangzhou Steel Rolling Mill No 3.

6248

CSO: 4009/396

AUTHOR: LI Jiyun [2621 4949 0061]
REN Shangxue [0117 1424 1331]
CHEN Daizhong [7115 0108 0022]

ORG: All of Northwestern Institute of Soil and Water Conservation, Chinese Academy of Sciences

TITLE: "A Study of Kaschi-Beck Disease Associated With Environmental Selenium in Shaanxi Province"

SOURCE: Dalian HUANJING KEXUE XUEBAO [ACTA SCIENTIAE CIRCUMSTANTIAE] in Chinese Vol 2 No 2, Jun 82 pp 91-101

TEXT OF ENGLISH ABSTRACT: In order to study Kaschi-Beck Disease in relation to environmental selenium, authors have collected samples of drinking water, soils, various kinds of grains, and children's hair from 130 locations in both affected and nonaffected areas according to different natural and geographical types in Shaanxi Province from 1978 to 1981, and also analyses of selenium were made in these samples. It can be seen from the results that the disease-affected areas all are of an environment where the selenium content stands very low, for example, in drinking water there are fewer than 0.2ppb in grains (average of wheat and corn,) fewer than 10ppb in over 95 percent of the samples examined, while in hair which reflects Se content in human body, there are fewer than 110ppb in over 92 percent of 478 children. In contrast, the areas where no Kaschi-Beck Disease has shown up are of an environment with low, medium, and high Se content in water, soils, and grains. The

[continuation of HUANJING KEXUE XUEBAO Vol 2 No 2, 1982 pp 91-101]

amount of Se provided for the children from water and grains has been calculated at 5.4 μg or so, with the lowest daily uptake in the nonaffected areas. It can also be shown by analyzing the results of the samples in all the locations that the amount of selenium in grains consists of up to 90 percent of the total amount of Se in grains and water in most locations in the areas and it has also indicated that grains are the main Se source in these areas. But in areas where the Se content in grains is low and that in water is high, Se from water may make a bigger contribution to Se in human body and no Kaschi-Beck Disease has so far been found. Preventive measures have been taken by periodic oral admission of sodium selenite (Se 1 mg/week) or salts with small amounts of sodium selenite (5 mg/kg.) They have proved to be effective in raising the Se content in the hair of the children in the disease affected areas.

AUTHOR: HU Rongmei [5170 2837 2734]
RUAN Yinlong [7086 6892 7893]
MA Lishan [7456 4539 3790]

ORG: All of Nanjing Institute of Pedology, Chinese Academy of Sciences

TITLE: "Study of Fluorine Pollution in Soil in Baotou Region"

SOURCE: Dalian HUANJING KEXUE XUEBAO [ACTA SCIENTIAE CIRCUMSTANTAE] in Chinese Vol 2 No 2, Jun 82 pp 143-149

TEXT OF ENGLISH ABSTRACT: Fluorine pollution in soil in Baotou Region has been studied and described. Distribution of soluble and total fluorine in soil can in some way reflect range and level of fluorine pollution in air in that region. Atmospheric fluorine pollution in this region can hardly be compared with that caused by tail-ore dam, involving solid waste and wastewater from ore-dressing and sintering plants, which according to data are main sources. Accumulation rate of fluorine in soils downstream of the dam is very high, sometimes over one ton fluorine per hectare per meter. Fluorine pollution in soil also causes contamination of ground water and vegetables. That results in relocation of the neighboring production units several years ago. It becomes clear that it is not the air fluorine pollution but the soil fluorine pollution intensified partly by the tail-ore dam. In view of serious impact made by the tail-ore dam on the environment, practical suggestions should be advanced to take preventive measures for extensive protection.

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CSO: 4009/342

END

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SCIENCE AND TECHNOLOGY

No. 179

COMPUTER DEVELOPMENT AND APPLICATIONS

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CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 179

COMPUTER DEVELOPMENT AND APPLICATIONS

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COMPUTER DEVELOPMENT IN CHINA REVIEWED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81, pp 1,2

[Article by Wang Jiayun [3076 1367 0061] of Huabei Computing Research Institute: "General Review of Our Country's Computer Technology and Enterprise (Part One)"]

[Text] Our country is way behind the industrially developed nations of the West as far as its capital investments in electronics industry and the proportion of investments in computer industry to electronics industry are concerned. In China, the industrial output value is less than one-thousandth of the gross national product. At present, computers are placed high on China's list of priority projects as one of the eight major comprehensive sciences and technologies which will bear influence on the overall situation. Special attention is being attached to the development of computers, which is a wise and bold decision of strategic importance.

Computing Technology

Development of China's computing technology began in 1956 and has gone through three generations of transformations. The early period, i.e., the electronic tube computer stage, was very short, most of which was spent on imitating Soviet M-3 and BESM-4 machines: programming was mostly wired by hand, and research was mainly based on the Soviet symbolic operator system. Very few products were produced during this period, and the machines were made obsolete in no time following the emergence of transistorized computers. Transistorized machines were first developed in 1960, and put on the production line in 1964, thus giving birth to the second generation. During this stage, most of the designing work was carried out on our own; software development included assemblers, supervisors and checking programs; research and applications gradually shifted towards such high-level algorithmic languages as ALGOL and BASIC. Through 6-7 years of practice, our country managed to foster a contingent of young, competent and experienced computer researchers and developers. Moreover, key research institutes gradually formed their own style and characteristics in design and application. The Academy of Sciences and institutions of higher education advanced ahead of the industrial sector in the realm of theoretical and applicative research. Transistorized computers opened up the frontier for the commercial production and extensive use of computers in our country, and greatly contributed to the building of China's national economy and national defense. At present, the large number of transistor computers are still operating. The

earliest product was 109.B; typical products include DJS06, 441BIII, X-2 and DJS121. As the immense importance and value of software heredity came to light, beginning in 1973, our computer technology moved into the third generation stage characterized by serialization and integration circuits. Through coordinative efforts among various research organizations, schools of higher education and factories which surmounted one difficulty after another, the DJS100, DJS180 minicomputer series followed by DJS200 medium/large frame computer series appeared in the domestic computer market in the late 1970's. Other notable machines of the same period include TQ-16, etc. These series have incorporated the merits of corresponding foreign-made series which are characterized by matured technology, good assortment of software, and extensive application. Excellent results have been achieved in applications with the DJS100 series which was designed in accordance with the actual conditions in our country and the first of its kind to enter the market. During this stage, software work focused mainly on the development and application of real-time and batch processing operating systems, diagnostic programs, and FORTRAN language. Moreover, research and development efforts were being made in the following areas: time-sharing system, COBOL, PASCAL, databases and network. The realization of serialization has enabled our country to devote more time and effort on the development of various kinds of operating systems, large variety of high level algorithmic languages and all kinds of service and maintenance programs. For instance, the DJS200 series has over 1 million bytes of software.

The newest, and also the most extensively used machines which have developed faster than any other kinds of computers are microprocessors. China began research and development in this area in 1974, and produced prototype models in 1975. In 1977, final decisions were made to develop eight models in the DJS050 series and DJS060 series. Technologically, the PMOS had already gradually moved to NMOS and I^2L. Moreover, the degree of integration continued to grow, thus bringing about the transition from multi-chip to single-chip CPU. As a result, prices have been coming down continuously. The most active elements in microprocessor research and development are found in institutions of higher education and some relatively small factories and [research] institutes. As microprocessor chips are very cheap in the international market, the use of imported chips for developing systems for users is gradually increasing, which will undoubtedly promote the growth and extensive use of microprocessors in the country. Microprocessors are widely used in such areas as energy, machinery, metallurgy, communications, education and national defense. Moreover, they have competitive prices. The development of microprocessors has received the highest attention and full support of the Computer Committee of the State Scientific and Technological Commission, and the State Computer Industry Association.

Table 1 shows the hardware technical characteristics of typical models which have been developed. Table 2 shows the software configuration of some series.

Some 40 computing technology research institutes and several hundred computer centers (stations) have been set all over the country by the electronics industrial sector, the Academy of Sciences, as well as other sectors and locally-administered organizations. Some 60 institutions of higher education have established computer science and engineering departments and disciplines, and

Table 1. Hardware Characteristics of Some Computer Models

Characteristics \ Model		TQ-16	DJS-183	655	151	150	DJS-260	013	HDS-9
Year produced		1971	1976	1972	1979	1973	1979	1976	1979
Main speed		11	20	90	110	120	100	150	
Main frequency MC		3	2.8-3.1	3	4	3.1	4	5	5-6
Word length (bit)		43	16	48	32	48	32	48	42
Number of general use registers			8	4		16	16	16-84	
Number of instructions		51	70		160	94	187	93-112	
Main memory	Technique	Mag Core	Mag Core	Mag Core	Mag Core	Mag Core	Mag Core	Mag Core	Mag Core
	Capacity	32	28	32KWx4	32KWx8	32KWx4	32KWx(2-8) Double Word	32KWx4	32KWx(6-18)
	Cycle (microsecond)	2	2.4	2	1-1.6	2	1.2	1.5	1.2
	Number of crossovers			2/4	4	4	4	4	2.8
High speed buffer	Technique	-	-	-	256-512	-	-		2x512
	Capacity				200-250				333
	Cycle ns								
Advanced control Flow				yes	yes	yes	yes	yes	yes
Multifunctional unit							yes		yes
Virtual memory					yes			yes	yes
								yes	yes

Table 2. General Survey of Computer Series Softwares

Software		Computer Model										
		DJS-100				DJS-180			DJS-200			
		110	130	131	140	182	183	184	10	20	40	60
Assembly		v	v	v	v				v	v	v	v
Macro assembly			v	v	v	v	v	v				
Expanded assembly			v	v								
ALGOL-60			v	v	v				v	v	v	v
Expanded ALGOL-60												
BASIC single user		v	v	v	v	v	v	v	v	v	v	v
BASIC multi user			v	v	v	v	v	v				
FORTRAN-IV			v	v	v	v	v	v	v	v	v	v
Expanded FORTRAN-IV									v	v	v	v
FORTRAN-V					v							
COBOL								v	v	v	v	v
Supervisor												
Operating systems	Real time	v	3*	3*	4*	v	v	v			DJS	
	Batch Processing								DJS -XT1	DJS -XT1	-XT2	DJS -XT3
	Time sharing											
Diagnostic programs		v	v	v	v	v	v	v	v	v	v	v
Notes						Also known as CK-800, SJ-55 series						

Footnote: In different system configurations, "3" represents SOS, RTOS or RDOS operating systems; "4" represents SOS, RTOS, RDOS or MRDOS.

have turned out quite a few technical people with specialized training for research, designing, manufacturing and application fields. As computer service centers appeared at a fairly late period of time in this country, there are over 1,500 organizations throughout the country that have their own in-house hardware maintenance and application software development personnel. There are approximately 70,000-80,000 people throughout the whole country who specialize in computer research, designing, manufacturing, application and education.

Each year, the China Computer Society organizes ten-odd academic exchange activities. In late 1979, nearly 400 papers were presented to the Fifth Annual Computer Convention held in Kunming. The papers reflected the achievements and level of research attained by China over the past year in such new architectures as large-frame vector computers, computers using crossbar (switching) units, online systems, distributed computer systems, multicomputer systems, network, array computers, fault tolerant systems, and recombination

systems. The papers also dealt with such areas as artificial intelligence, theorem proving, n-valued logic, pattern recognition, as well as such computer applications as transaction processing and industrial process control.

Although our country has managed to form a large research and development contingent for mainframe designing, peripherals and components, the forces are fairly scattered and lack sound organization and coordination. As we are still fairly weak in such areas as precision machinery processing, basic materials and technologies/techniques, the development of peripherals and components has always lagged behind the development of mainframes. In recent years, we have further intensified our investments and research forces in these weak areas.

Looking at the growth of China's computer industry, according to incomplete statistics, from 1956 to 1970, the accumulative total of installed machines grew at the average rate of 28.6 percent. If the accumulative total continues to grow at this rate in the future, by 1985 our country will have produced 11,778 machines; by 1990, the accumulative total will be 41,428, which is less than the total number of machines installed in the United States in 1976. By that time, there will be 35 machines (currently 3 machines) available for every one million persons, which is near the 1976 level of Spain (which ranks 12th place in the world). It can be seen that in the forthcoming decade, owing to the comparatively small radix and the great demand for computers, it will be possible to maintain the current growth rate, which will be quite adequate for the needs of the developing situation.

China imports computers from 14 countries; by early 1979, the total figure reached 294 machines. Of all the imported computers, 37.7 percent had been imported from the United States, 30.3 percent from Japan, 9.9 percent from France, 8.8 percent from West Germany, and 3.1 percent from England. NOVA machines accounted for the largest proportion (10.9 percent) of imported equipment; PDP-8 and PDP-11 ranked second place (6.8 percent). Although imported computers only account for 11.5 percent of the China market, they have brought tremendous impact on domestically produced machines.

Peripherals are a weak link in our country's computer hardware industry. At present, the industrial sector can only provide users with 10 different varieties of equipment, totaling 41 different models. Some users have to approach research organizations in order to purchase peripherals which can meet their high-standard requirements. The problems underlining our peripheral products are: lack of quality and variety, and the great disparity among magnetic disks, which have affected the popularization of computers. Our country has now developed a certain capacity for producing peripherals.

What is especially worth mentioning here is the fact that the popularization of computers is still the weakest link in China. One encouraging development in recent years is the emergence of computer application service centers. But this is still a far cry from satisfying the daily growing market demands.

The author believes that the current slump in computer industry brought about by the adjustments being made in our national economy is only temporary. As

As improvements are made in our nation's economic management, more factories, mines and enterprises will need scientific production planning and financial management. From the current realm of applications which draw heavily on technical, financial, and know-how resources, our computer industry will move on to broader use primarily in the areas of transaction data processing. In view of the extensive use of computers and shortage of software, the computer industry will increase its work forces to meet the situation.

Table

Country	Company	Model	Number of machines installed (A)	Market share percent (A/B)	Market share percent (C/B)
United States	DEC	PDP-8, 11	20	6.8	
	Varian	620/L-100	14	4.75	
	Wang	2200	14	4.75	
	DGC	NOVA	9	3.1	
	HP	9800,2100	8	2.7	
	Others		46	15.6	
	Accumulative total C		111		37.7
Japan	Minicomputers	NOVA	23	7.8	
	Shimazu	CT, DCP	10	3.4	
	Hitachi	HIDIC, M	9	3.1	
	Hokushin	HOC	6	2.0	
	Others		41	14.0	
	Accumulative total C		89		30.3
France	Telemecanique	SOLAR	6	2.05	
	Intertechnique	MULTI	6	2.05	
	Others		17	5.8	
	Accumulative total C		29		9.9
West Germany	Siemens	7700, 330	11	3.7	
		cp550	15	5.1	
	Accumulative total C		26		8.8
United Kingdom	C		9	3.1	3.1
Eastern Europe/USSR (5 countries)	C		18	6.1	6.1
West/Northern Europe (4 countries)	C		12	4.1	4.1
Grand Total B			294	100.0	100.0

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IDEAS ON DEVELOPING CHINA'S MICROCOMPUTER TECHNOLOGY GIVEN

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 13, 5 Jul 81 pp 1,2

[Article by Professor Li Sanli [2621 0005 4539], Qinhua University: "Some Ideas on Developing Microcomputer Technology in Our Country"]

[Text] Paying attention to developing trends in foreign countries and drawing on the experiences of others can be helpful in bringing about modernization of our country's science and technology. In this article, the author looks into the practical experiences of foreign countries and combines them with some of his ideas on developing China's microcomputer technology.

(1) How to develop 16-bit microcomputer technology: It was in 1978 when 16-bit fourth generation microprocessors made their debut in foreign countries. Over the past 2 years, the Americans have summed up quite a few positive and negative experiences. in the past, Intel always strove to be the first to come up with new 8-bit and 16-bit machines, but neither product line had been thought out systematically or comprehensively. National Semiconductor developed 32-bit, 16-bit and 8-bit machines as an integrated series, and began producing NS16032, NS16016 and NS16008 series. Subsequently, Intel finally came to recognize the importance of developing microcomputers along the same lines as minicomputers and large frame machines, and they should all be designed as one entire series. Last year, Intel announced it would produce 32-bit, 16-bit and 8-bit iAPX series machines: iAPX432, iAPX286/288 and iAPX186/188. Intel also planned to combine the original 8086 and 8088 with 8087 and 8089 into iAPX86/88. The object code of 8-bit iAPX186/188 would be compatible with 8086 (8088) in order to replace 8085, prevail over Z80, and eventually dominate the 8-bit microcomputer market. Evolved from 8086 technology, 16-bit iAPX286/288 machines are five times faster than iAPX86 and also configured with memory management and protection capabilities to overcome the fundamental drawbacks of 8086. They also have 16 megabyte real address capability. iAPX432 is a 32-bit product composed of 43201 instruction decoder (100,000 transistors), 43202 microinstruction executor (60,000 transistors) and 43203 interface processor (65,000 transistors); the operating system is hardware (installed in solid-state circuit) and the ADA language is used. Zilog also announced it would develop Z8003 and Z8004 which were to be improved products based on Z8001 and Z8002. Thus, it can be seen that 16-bit microprocessors went through fairly great turbulences. Up to now, there is no steady marketplace for general-purpose microcomputer systems composed of 16-bit fourth generation microcomputers. Those manufacturers who announced last year that they would produce

16-bit general purpose microcomputer systems have now found themselves in an awkward predicament. Thus, there is no need at all for China to follow the "fashion" by introducing or imitating 16-bit general-purpose microcomputer systems. As this kind of technology is immature at the moment, it is best to wait and see for a while. But this does not mean at all that we cannot use 16-bit single board models (e.g., SDK86 or iSBC86) for special data processing or data control--this type of technology is quite mature and extensively used in other countries, and some organizations in our country actually have practical needs for it. Nor does it mean that we should not enhance our efforts in the study, analysis and digestion of information on 16-bit microprocessor technology, such as Intel 8086, Z8000 and MC6800. Past experience should be remembered. In 1974-1975, a group of researchers in our country began intensive research on Intel 8080; it was precisely due to their efforts that we acquired the ability in 1980 to produce 050 and 060 series machines. 16-bit microcomputer technology is even more complex. If we intend to develop the capacity to produce 16-bit series machines by the mid-1980's, we must now begin to organize intensive research on 16-bit microcomputer technology.

(2) Direction in which importing and developing 8-bit computer system technology should be carried out: At present, we are still focusing on 8-bit machines which also constitute the chief line of products being imported into this country at the price of enormous sums of foreign currencies. In foreign countries, two remarkable trends in the development of 8-bit microcomputer systems have taken shape: First, the higher end of 8-bit microcomputer systems (price range: $8,0000-10,000) are seriously challenged by microminicomputers (such as LSI-11 cpu systems). The prices of microminicomputers are still coming down and there is a great variety of software for such machines. Thus, microminicomputers have the upper hand in the competition. As the higher end of microcomputer systems are not doing well in foreign markets, many manufacturers have turned to low-price microcomputer systems in the approximate range of $4,000. For an additional amount of $4,000, such systems can be upgraded with 8 inch Winchester hard disks with capacities ranging from 10 megabytes to 18 megabytes. Besides, since the second half of 1980, large quantities of 8-bit multiprocessor systems have emerged. Generally, a work station consists of a stand-alone terminal microcomputer configured in an operating system and four kinds of high-level languages; but multiple work stations can share one or more hard disks. The mode of resource sharing can either be simple chain structure or bus arbitration structure.

While thousands of 8-bit microcomputers have been imported into our country, the selection is often based on the recommendation of one or two Hong Kong or foreign dealers. Some of the treasured models are actually obsolete in foreign countries due to excessive radiation harmful to health. Some of the foreign merchants who are treated as honored guests are actually dumping unsalable products into China at exorbitant prices. All this is related to the fact that we are not well informed on market conditions. The author believes that we should first of all greatly strengthen and support the development of Chinese-made 8-bit microcomputers, and develop the software needed for system configuration as soon as possible. Even the 050 or 060 series can satisfy the basic needs of our country for 3 or 5 years if we can commercially produce such

microcomputer systems configured with 64 K memories, floppy disks, printers, and CRT display units, and furnish them with CP/M or ISIS operating systems and three or four high-level languages. Secondly, it is necessary to import an appropriate quantity of foreign-made models, but the models should be representative of the latest technology and not obsolete or unsalable goods. Before any model is imported, it is important to solicit suggestions from all departments, especially technicians of other departments, so as to minimize biased decisions. To a certain degree, the importation of small quantities of low-price models with hard disks or multicomputer capacity for the purpose of analysis and digestion can be of value to the improvement of 8-bit microcomputer technology in our country.

Another problem is how to make maximum use of the several thousands of microcomputer systems which have already been imported or developed. It is reported that many users use such machines merely for BASIC language programs, which is really a pity. For BASIC, machines in the $400-500 price range would be quite sufficient--why spend thousands of dollars? Moreover, if all of the several thousands of microcomputers were used only for scientific computation work, the market would become saturated in no time. It is necessary to vigorously popularize 8-bit microcomputer applications, especially those related to industrial, business and agricultural management.

(3) Vigorously develop the applications of single-board machines: In foreign countries, OEM is still the largest market for microprocessors, especially single-board machines. Our country is way behind in this area. The popularization of single-board machine applications can have an immediate effect on the improvement of the productive and technical level of China's industry and agriculture, and should thus be given due attention by all organizations. The author also advocates the need for China to design its own single-board machines in accordance with practical needs in the country. At present, there are not enough single-board machines to meet the demands in foreign countries, and their prices are going up while chips are still becoming increasingly cheaper. Our country should take advantage of this opportunity to import chips and start designing and assembling its own single-board machines. The prices of foreign-made single-board machines designed for basic instructional and simple control uses range approximately from $350 to $400; the cost for designing our own machines with imported chips would cost approximately $150-200, and it is also possible to produce machines with better performance than foreign-made products. This is one of the few computer products competitive in foreign markets that our country is able to produce. China's technical force is fully capable of designing high quality single-board machines.

(4) Attach importance to the role of microcomputers in education and training: Over the past 20 odd ears, the computer enterprise in our country has been in a state of "three divorces," i.e., hardware divorced from software, processor divorced from system, mainframe divorced from application, which has gravely affected the progress of our computer enterprise. The "three divorces" state is related to the drawbacks which have existed in our computer science education for many years. In other countries, computers are taught as a complete system in many university-level computer science courses. For example,

MIT's "Computer Structure" course begins from computing methods to software designing, and finally hardware implementation; all this is taught as one complete course. Other courses, such as program designing, operating systems, etc. also follow similar lines. By the time they complete the courses, the students will have mastered the use of computers. In China, due to limited funding, many schools cannot afford to purchase large or medium frame machines; they should thus focus on microcomputer systems. Microcomputer systems are cheaper, and although they may be small, they are quite complete in terms of capabilities and functions. Moreover, they are excellent for interactive work with students. With microcomputers, it is entirely possible to combine software with hardware, processor with system, and mainframe with application in the classroom. In the past, lessons on microcomputers used to be regarded as the continuation of courses on medium and large scale integrated circuits, i.e., they were taught as "hardware" courses; this kind of concept is wrong. The training of people is an undertaking of vital and lasting importance. It is hoped that all schools will enhance the role of microcomputers in computer science education, and continuously sum up experiences. All concerned organizations should not overemphasize large-frame computer centers; instead, they should provide adequate funding and support to universities and colleges which want to set up microcomputer systems.

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FIRST MICROCOMPUTER WITH LARGE-SCALE INTEGRATED CIRCUITS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81 pp 1,4

[Article: "DJS-062 Microcomputer Successfully Produced"]

[Text] Jointly developed by the Liaohe Experimental Research Institute and other organizations, the DJ2-062 microcomputer made its debut in June 1980 at the National Computer Exhibition sponsored by the State Computer Bureau and won excellent commendations as the first-ever microcomputer with large-scale integrated circuits totally manufactured in China. On the eve of National Day 1980, as the result of further research and development, the Institute produced the DJS-062A single-board microcomputer with large-scale integrated circuits completely designed and manufactured by its own personnel. The size of the model is 312 x 220 x 25.5 mm. It weighs 900 grams and its technical characteristics have reached the same level as Motorola's 8-bit microprocessor (MEK6800/D2).

The word length measures 8 bits and the machine can handle double-length or multiple-length computation with 16-bit addresses. An 8-bit duplex data bus is employed, and the main frequency is 612.5 KHz.

The microcomputer is equipped with 72 commands, 197 machine codes, 7 addressing modes. The execution of a command takes from 3.25 to 19.5 microseconds to complete. The execution time of 80 percent of the commands falls within 8.15 microseconds.

The single-board model has a 1 kilobyte random-access memory (1 kilobyte static RAM), 1 kilobyte monitor program memory (8 K ROM), 1 kilobyte user-erasable memory (8 K EPROM). Depending on the user's requirements, 8 to 24 kilobytes of memory can be added to the machine.

The computer has a fairly good interface capacity for accommodating external equipment; it is equipped with parallel peripheral interface adapter (PIA) and serial asynchronous communication interface adapter (ACIA). Various types of peripherals can be tied into the system through the same interface; this is achieved by merely altering the program to change the function of the interface.

The microcomputer has an online keyboard with 16 numerical keys, 8 command keys, 6 Nixie tubes (4 for displaying addresses, 2 for displaying data), an

audio-frequency cassette tape drive, and a small printer (DP-822 model, 21 column narrow-width printer). In addition, the user has the option of installing a 32-64 column visual display unit (CZX-1 type CRT) for displaying simple characters, as well as optical reader, punch-card machine, 80 column (wide column) printer, and X-Y function graph plotter.

The software system now supports the following: (1) JBUG supervisor (fixed in ROM); (2) peripheral supervision programs; (3) MPU, PIA, RAM self-checking programs; (4) analog programs (using DJS-130 analog DJS-060 series); (5) character-display control programs, etc. Besides, it also has BASIC, self-compiling compiler, etc. which is quite useful. The large-scale integrated circuits and TTL interface circuitry in the DJS-062 model are all produced by the institute and includes the following: (1) microprocessor; (2) 1 K static RAM; (3) peripheral interface adapter; (4) 8 K ROM; (5) (serial) asynchronous communication interface adapter; (6) 8 K erasable ROM; (7) 8-bit digital-analog converter; (8) 8-bit analog-digital converter; (9) 8-line 3-state driver; (10) 8-line power gate drive; and (11) 8-line OC gate drive.

The preceding parts were all developed and produced with China-made installations, such as the PB-1800 automatic photolithographic machine; the DJS-130 computer put out by Beijing Radio Plant No 3; the TF-1 pattern generator; J59-60 60 KEV ion implanter; laser positioning type II and Type III step-and-repeat system produced by Qinghua University in Beijing; and the grating positioning JS-3 type 4-head microreducer produced by another institute. Some installations were put to use only recently. The trial production of large scale integrated circuits proves that China-made installations can perform fairly well and meet the designed performance requirements as well.

Following their successful development, the DJS-061 multi-chip and DJS-062 single-chip models have already begun to be used in a number of applications. Besides the preceding microprocessor program-controlled character display and microprocessor program-controlled wire printer, the institute has also ventured into such areas as the application of microprocessor-controlled diffusion furnace, and conducting large-scale integrated circuit tests controlled by DJS-060 series microcomputers; the results have been gradually introduced to all the research divisions in the institute. In some fraternal organizations, the DJS-060 microcomputer system is used for producing video frequency charts on radar display units and used in conjunction with the computer mainframe of an engineering tracking system; it is also used for controlling log separators in the forestry industry, as well as for controlling machine tools.

The institute is now actively engaged in further research efforts to develop all kinds of software for this type of microcomputer, expand its system capability, and switch from trial production to batch production as soon as possible.

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FIVE-YEAR MICROCOMPUTER SOFTWARE FORECAST

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 13, 5 Jul 81 p 2

[Article: "Five-Year Forecast for Microcomputer Software"]

[Text] 1981

•IBM introduces 380 Personal Computer System with computing capabilities compatible with IBM370 mainframe, priced below $3,000.

1982

•Japanese manufacturers launch massive invasion of home computer market with very powerful personal computers compatible with Micro Soft's currently available BASIC and CP/M software library. Price under $300.

•Knight-Ridder and American Telephone and Telegraph announce joint nationwide visual data service.

•United Services of America (?), Computserve and Radio Shack start marketing the 50th electronic system for household banking application.

•Powerful but inexpensive comprehensive video frequency terminals on the market.

•Program generators will make up for the shortage of programmers, but not for talented system analysts.

1983

•All major printed circuit manufacturers will either set up software departments or buy stocks from software firms.

•All major toy and recreational equipment companies will set up software departments.

•Software firms with $100 million annual sales volume will emerge.

1985

- Birth of the 1,000th computer software manufacturer.
- Manufacturers agree on various standards for software and high-level languages.
- English-language programming becomes the overwhelming majority portion of the software market.

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DJS-130B MICROCOMPUTER TO BE PRODUCED, MARKETED 'SOON'

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 18, 20 Sep 81 p 1

[Article: "DJS-130B Computer Will Be Available Soon"]

[Text] The DJS-130B Electronic Digital Computer Evaluation Meeting was held in Shanghai on July 30-31. Present at the meeting were 200-odd representatives who carefully reviewed and evaluated the computer which had been jointly developed and manufactured by the Huadong [East China] Computing Institute and Shanghai Zhongxing Radio Plant.

The participants agreed that besides hardware/software interface compatibility with the original DJS-130 machine, the B model had remarkably improved performance and structure. B model's main memory consists of 8 K x 16 bit basic cells composed of imported 4 K dynamic MOS storage components, and can be expanded to 32 K. Dual-in-line packaged [DIP] medium and small scaled integrated circuits are used, and necessary simplifications and adjustments are made in the logic, thus not only increasing operation speed from the original DJS-130 level of 500,000 operations per second to over 800,000 operations per second, but also reducing the size to one-fourth of the original model, and cutting the cost by one-half.

During the evaluation stage, the participants revised an on-site operation demonstration of the DJS-130B model; they thought very highly of the machine's reliability and resistance to interruption, and gave a lot of valuable ideas and suggestions with regard to improving the machine's performance. The representatives were unanimous in expressing hope that the design of this model would be finalized soon for production and marketing.

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MIC-85 SINGLE-BOARD MICROCOMPUTER NOW IN BATCH PRODUCTION

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 81 p 1

[Article: "MIC-85 Single Board Microcomputer Now in Batch Production"]

[Text] The MIC-85 single board microcomputer was developed by the Microcomputer Research Section of Shanghai Jiaotong University. All the components are installed on a single 350 x 270 square mm double-side printed wiring board, thus constituting an integral microcomputer which can be extensively used in education, training, data processing, process control. digital communication, signal control and LSI circuit testing. It is fully compatible with the SDK-85, a foreign made model; but its capabilities are considerably expanded.

The MIC-85 uses an 8088A for its CPU; the clock frequency is 3.072 MHz; the basic instruction execution time is 1.3 microseconds. An 8 kilobyte low power dissipation static RAM and an 8 kilobyte EPROM are installed on the board. The single board model runs on a 5-volt power supply. Configured with the board are a 6-digit hexadecimal display unit and a hexadecimal keyboard. It is equipped with such interface circuits as audio cassette recorder interface, standard CRT interface, wire printer interface and EPROM programmer.

The MIC-85 has relatively good performance/cost ratio; its parts are manufactured both in China and foreign countries, i.e., foreign parts are used wherever Chinese made ones are not up to international standard.

The MIC-85 microcomputer is currently produced in large volume by Shanghai Jiaotong University. To ensure that users can purchase MIC-85 single board machines at prices no higher than comparable domestic products, the floating price system is used. The Hong Kong Jing Ye Computer Company is prepared to handle marketing abroad.

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MIC-85 MICROCOMPUTER NUMERICAL CONTROL SYSTEM

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81 p 9

[Article: "New Microcomputer Numerical Control System for Wire Cutting Machine Tools"]

[Text] With the full support of Shanghai Machine Tool Plant No 8, the Shanghai Machine Tool Research Institute and the Shanghai Jiaotong University jointly developed a new microcomputer numerical control system (MCNCS) for wire cutting machine tools in half a year's time. On 27 December 1980, the system passed the Scientific Research Achievements Evaluation Test.

The research started as one of Shanghai City's major scientific research projects. The successful development of the system constitutes an encouraging step for the application of microcomputers in machine tool control. The microcomputer system has been used for controlling taper cutting and withdrawing broken-wire to the processing points(?), thus filling in the gap in China's numerical controlled machine tools. Based on the results of preliminary test runs on scores of parts and tests conducted by an evaluation group, the system has demonstrated such capabilities as controlling linear/arc slotting (?), taper cutting below 1°, withdrawing broken-wire processing point (?), skip processing (?), etc. The system is configured with automatic programming software, and can correctly compose programs for controlling the processing of complex parts and tapered parts. The system employs the technically-advanced MIC-85 microcomputer which has an 8085A central processing unit and is compatible with DJS-051 and DJS-052. The system can use a cassette recorder which can input large volumes of processing programs in one read session; there is no need for punching or verifying paper tapes, thus eliminating the need for tedious work and greatly reducing the use of manpower. The debugging of system software and automatic programming software can be performed with DJS-053 or Z-80 machines; thus, the system has room for expansion. Compared with the original numerical control box system, microcomputer numerical control systems have such advantages as stability and reliability, good adaptability, easy to operate and maintain. Owing to its low power consumption, compact size, light weight and great flexibility, it can be easily integrated into a machine tool.

Based on evaluation tests, the system is quite successful and its performance is up to the domestic advanced level. During the trial use stage, the machine tool was used to cut a 30' tapered part with complex geometric design for the

Shanghai Wired Communications Plant. Through automatic programming, the system processed the product according to the geometric and tapered specifications. Both the factory and evaluation test group were satisfied with the result, and they believed that the system had great practical and economic values. The participants at the evaluation meeting hoped that the blueprints for the integration of the machine tool and computer system would be produced as early as possible to meet the needs of users.

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DJS-054 MICROCOMPUTER COMMERCIALLY PRODUCED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 Sep 81 p 3

[Article: "DJS-054 Microcomputer Finalized and Put Into Mass Production"]

[Text] A meeting was held in Shanghai on 28 July to finalize the design of the DJS-054 microcomputer produced on trial basis by the Shanghai Computer Plant. Based on system capability tests, mainframe and system stability tests and routine tests, as well as long period of trial use by various users, the representatives at the meeting unanimously agreed that the DJS-054 microcomputer had reached the domestic advanced level as far as its system stability and reliability, environmental adaptability and hardware/software performance were concerned.

The CPU of the DJS-054 machine is an 8-bit 8080A processor and its characteristics are as follows: word length 8 bits; 78 basic instructions; instruction cycle 2-9 microseconds. An S-100 bus is employed, and all the bus signals are compatible with TTL level. Memory: ROM and RAM; transistorized memory; 8 K modular expansion, maximum direct addressing 64 kilobytes.

Input/Output: asynchronous waiting, 1-line 8-level priority vectored interrupt and direct memory access capabilities; I/O instruction direct addressing 256 input ports and 256 output ports. The system can support floppy disk storage, CRT character display unit, cassette tape drive, photoelectric unit, paper tape punch unit, console monitor typewriter with keyboard, high speed line printer, analog I/O, switching I/O, etc.

System software: CP/M 1.4 operating system, under which are: utility programs, such high level languages as CBASIC, PASCAL and PL/M; as well as monitor, editor, debugging routines, arithmetic library, etc. At present, imported LSI circuits are used in DJS-054 machines. But Shanghai's trial-produced 8080 family components are completely suitable for substituting any of the parts in the machine. All peripherals are made in China, which makes it convenient not only for maintenance, but also for popularization.

The DJS-054 model is used fairly extensively; it can play a useful role in such areas as: data gathering, industrial control, scientific experiment, enterprise management, commerce, communication, biology, medicine and education. It can also serve as microcomputer developing system where it has an enormous capacity for development work. It can also be used as multiple-level control in larger application systems.

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W6800 8-BIT SINGLE-CHIP DJS-062 MICROCOMPUTER DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 10, 20 May 81 p 1

[Article: "Sichuan Solid State Circuit Research Institute Successfully Develops DJS-062 Microcomputer With Single Chip Microprocessor"]

[Text] Recently, the Sichuan Solid State Circuit Research Institute successfully developed the DJS-062 microcomputer which is completely composed of Chinese-made components, including its own LSI circuit products, such as the W6800 8-bit single chip microprocessor, W6820 1024-bit static RAM, W6830 8192-bit read-only memory (ROM), and I/O interfaces. The design of the microcomputer was formerly evaluated and finalized at a ministerial level design-finalization meeting which was held from the 15th to 19th of April this year.

The microcomputer represents the first finalized 062 machine developed on the basis of the W6800 single chip 8-bit microprocessor produced in China. Its performance has reached the same level as MEK6800, a foreign-make comparable model. Following are its main characteristics:

Main frequency	:	614.4 KHz
Wordlength	:	8 bits (parallel operation)
Basic instructions	:	72 instructions, 197 machine language codes
Address mode	:	7 modes, addressable memory 65 K
Memory capacity	:	Expandable to 2.5-4.5 K, maximum 64 K bytes
Interrupt ability	:	3 levels of hardware interrupt and 1 level of software interrupt

Through reliability and durability tests, as well as trial use over a long period of time by the Chongqing Instruments and Automation Institute, the performance of this particular model has proven to be both stable and reliable.

The Sichuan Solid State Circuit Research Institute is now manufacturing this type of microcomputer on small-scale production basis.

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DJS-130 COMPUTER TEACHING SYSTEM DEVELOPED BY ZHENGZHOU ENGINEERING COLLEGE

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81 p 5

[Article: "Zhengzhou Engineering College Develops DJS-130 Computing Education System"]

[Text] For some time, instructors and students of higher educational institutions had no access to computers, thus affecting the problem of improving the quality of education. To remedy this situation, the Zhengzhou Engineering College has developed a basic but effective multi-terminal computer teaching system under the supervision of the Henan Provincial Science Committee, Bureau of Education, and Electronics Bureau, and with the cooperation of Kaifeng Computing Institute, Shaoyang Radio Plant and Weifang Computer Plant. The system consists of the Chinese-made DJS-130 minicomputer which supports magnetic tape drive, multiplex communication control unit, and 12 (or 16) online terminals; its software consists of real-time disk operating system (RDOS) under which multi-user BASIC and FORTRAN system programs and application softwares are supported.

Since June 1980 when it was first put to operational use, almost 800 users on and off the campus have logged onto the system; students in groups of 20 have learned programming languages through online terminals with 4-5 online hours per semester for each person.

Although the system is fairly simple, it requires little investment and the results are excellent. Under current conditions, it can meet the demands for solving small computational problems in education and scientific research work. The system has, moreover, withstood stringent evaluation tests. This is the first multiple terminal system ever used in China's higher educational schools. It is a remarkable achievement which will enable schools of higher education in general to set up inexpensive but functional computing education systems of their own. In order to satisfy the demands of educational organizations and the broad ranks of users for multiple terminal computer systems, the computer service company of the main bureau will provide contract support service to users of the system, including installation, debugging, maintenance and training; schools of higher education can have special price discounts and credit loan service.

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TD REMOTE TIME DIVISION SYSTEM DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 16, 20 Aug 81 p 1

[Article: "TD Remote Time Division Online System Successfully Developed by Ministry of Post and Communications"]

[Text] The Data Transmission Research Institute of the Ministry of Post and Communications and the Computer Science Department of Nanjing University have jointly developed a remote time division online system completely composed of Chinese-made equipment; the system passed the technical evaluation tests organized by the Research Academy of Post and Telecommunications Science on 2-6 June. Some 40 representatives of 30-odd organizations participated in the evaluation meeting, including the Chinese Academy of Sciences, various ministries and commissions, as well as universities and colleges.

With the TQ-16 as the mainframe, the system is confirmed with a complete set of Chinese-made hardware equipment, such as the DJ01 front-end minicomputer, dual interface, multiple controller, modem, and Model 55 teletypes developed by the Data Transmission Research Institute under the Ministry of Post and Communications. It is also configured with time division operating system, interactive language, and software for handling post and telecommunications business which were jointly developed by the Data Transmission Research Institute of the Ministry of Post and Communications and Nanjing University. The time division system can accommodate four terminals simultaneously logged onto the host computer through communication networks.

Since August 1980, four terminals located in Hangzhou, Shijiazhuang, Hefei and Beijing have been used for numerous and lengthy trial runs, such as scientific computations and postal/telecommunication business job runs. The results showed excellent system performance and stability.

Three 50 baud online terminals were used during the technical evaluation period and were distributed along the Beijing/Shijiazhuang and Beijing-Hefei-Beijing loop lines. The three terminals worked simultaneously, and the entire system worked for 36 consecutive hours before manual termination of the run. The test operation went very smoothly and all predetermined test items were successfully completed.

The participating representatives agreed that the remote time division capability of the preceding TD online system had been successfully achieved by employing the CPU-peripheral serial configuration with the Chinese-made TQ-16 machine as the mainframe supporting a front-end minicomputer, dual interface, dual-processor operating system and digital transmission system. It was a successful attempt and breakthrough which reached the domestic advanced level. The representatives pointed out that if the large number of domestically-produced TQ-16 machines could be improved along the same line, it would be possible to greatly increase the utilization ratio at low cost. They suggested the popularization of this particular achievement, which would help expand the application range of computers and develop computer-data communication systems.

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CJ-709 FORTRAN COMPILER SYSTEM DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 3, 14 Feb 81 p 6

[Article: "FORTRAN Compiler System Available in CJ-709 Computer"]

[Text] Internationally, FORTRAN is one of the most popular high-level programming languages. With the ever-increasing number of contacts with the international community, the volume of technical information on FORTRAN programming and application software is also increasing day by day. Designed in China, the CJ-709 medium-frame computer (currently one of the chief types of computers used for scientific computations in the Shanghai Area) used to support ALGOL only. To make maximum use of available computer resources, the Shanghai Machinery Institute, Shanghai Medical Designing Institute and the Shanghai Power Equipment Research Institute jointly developed the CJ-709 FORTRAN compiler system which has been tested and approved for practical use.

Based on the ISO version of the FORTRAN text which is widely used in the international community, the CJ-709 FORTRAN text was developed according to the specific characteristics of the CJ-709 machine, putting in an appropriate amount of restriction and expansion.

The chief characteristics of the text compiler system are:

(1) Composed of five modules: Overall control module, sequence module, syntax analysis module, code generation module, and run subroutine module. The overall control module is designed for controlling and scheduling, and it is often installed in the internal storage. There are no direct links or scheduling among the other modules; they can only interact with the overall control module which governs and schedules them.

(2) 3-pass scanning. The first pass uses the subroutine method for syntax analysis, partial syntax checking, generating L1 intermediate language and corresponding tables. The second pass uses the transition matrices method for syntax analysis, generating quarternary forms as well as for expression optimization and partial loop optimization. The third pass converts the source program into its equivalent object program in machine language instruction form.

(3) The entire compiler system was developed with the ASSEMBLY language which is easier to read, easier to revise and debug than manual programming.

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SOFTWARE PACKAGE FOR CTS-2 PLOTTER PASSES EVALUATION TEST

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 3, 14 Feb 81 p 1

[Article: "Software Package for CTS-2 Automatic Plotter Passes Evaluation Test"]

[Text] The Computer Aid designing Center and Engineering Drafting Teaching and Research Group of Qinghua University have jointly developed a general-purpose plotting software package for the CTS-2 automatic plotter. Last November, the package won excellent commendations at a CTS-2 evaluation meeting.

With the DJS-130 computer and its disk operating system RDOS as the basic resources, the plotting package was written partly in FORTRAN-IV and partly in the assembler language, using basic statements and instructions. It includes 31 basic subprograms and 72 character subprograms. The machine can draw straight lines, circular arcs as well as basic graphs composed of lines and arcs; it can also cause graphs to undergo translation, rotation or scale transformation. In the course of software development, emphasis was placed on simplifying program structure by fully adapting to and utilizing the hardware characteristics of the CTS-2 Plotter. As the package is composed of FORTRAN subprograms, the user can draw all kinds of graphs by calling up the subprograms. Users who already know the FORTRAN language do not require special training for using this package. It is an excellent means for plotting all kinds of charts used in civil engineering, machinery, large-scale integrated circuit, topographical survey, etc. With a minimum amount of modifications in the subprograms, the package can be used in other types of plotters and computers.

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SEMICONDUCTOR RESEARCH INSTITUTE DEVELOPS 16 K ROS RAM

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 3, 14 Feb 81 p 1

[Article: "China's LSI Research Results in Successful Development of 16 K MOS RAM"]

[Text] In October 1980, the Semiconductor Research Institute of the Chinese Academy of Sciences successfully developed the 16 K N-channel MOS dynamic random-access memory (RAM), which was a very encouraging step forward in China's LSI production.

The institute began the research project in early 1980. In less than 10 months time, the group of researchers overcame one obstacle after another under the personal guidance of the institute's deputy director, Wang Shouwu [3769 1343 2976], who is a famous semiconductor expert. In no time, they succeeded in designing the circuit and wafer pattern. The raw materials and technological equipment were basically supplied from domestic sources, thus creating favorable conditions for production in the future.

In the course of research, they strictly adhered to the laws of science, stressing the optimization of each and every link, and ensuring both the quality and stability of the technologies involved. On the basis of 4 K RAM single chip unit, they developed the dual-layer multiple silicon technology, thus further improving the level of integration, which enabled them to produce the multiple address time-sharing input type 16-lead 16 K dynamic RAM. It has a minimum line width of 5 micrometers: the chip size is 3.5 x 5.9 square millimeters; the total number of integrated components is approximately 37,000. The chip access time can reach 150 nanoseconds; the timing period is 375 nanoseconds. The power dissipation is 500 milliwatts. It operates on +12V, +5V and -5V sources. The input and output are TTL compatible. The configuration of the base-pin leads conforms to international standard.

Most of the researchers are young and talented people in China's semiconductor field. But they are not content with the current achievement. Instead, they regard it as merely a starting point. They believe that the whole purpose behind the research is to serve the society at large, and the fruits of their efforts should be transformed into the productive force and material wealth of

the society. To further enhance the quality and reliability of the product, improve the rate of finished products, and lower the cost, they are conducting even greater in-depth research and going further into the application of new techniques and new technologies, thus making even greater contributions to China's LSI research and development as well as production.

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DJS-140 CAPABILITY ENHANCED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 5 May 81 p 1

[Article: "DJS-140 Capabilities Enhanced"]

[Text] On behalf of the State Bureau of Computer Industry, the Beijing Electronics Instruments Bureau sponsored a DJS-140 Evaluation Meeting on 15-17 April, during which three machines trial-produced by Beijing Computer Plant No 3 were put through comprehensive testing and evaluation sessions. The participants of the meeting included 169 representatives from concerned leading organizations, scientific research organizations, institutions of higher education, industrial plants, and a total of 115 user organizations. Director Li Rui and Deputy Director Xia Mingwen of the State Bureau delivered important speeches at the meeting.

The evaluation meeting organized a machine assessment group consisting of 10 organizations, including Beijing Wire Communication Equipment Plant and Qinghua University, which conducted comprehensive system testing on the mainframe's stability, power deviation, resistance to interruption, interfaces and peripherals, ability to restart after power failure, as well as all the software supported by the machine. The representatives at the meeting carefully listened to and discussed all the assessment reports and examination reports, and watched demonstrations of machines under actual operation.

The participants agreed that on the basis of the finalized version of the prototype machine developed by a joint design group, the DJS-140 model produced by Beijing Computer Plant No 3 was characterized by improved structural technology, further enhanced capability, and fairly good job performance.

The evaluation results indicated excellent system stability and reliability; the continuous run time of the test machines accumulated to over 600 hours. The interfaces for magnetic disks, magnetic tapes and serial QTY were improved and perfected; the internal storage transformer drive [float] switch plan was successful. The mainframes have new rationally designed structures; the printed backplate wire wrapping technology was successfully applied. On the basis of the original software configuration, the following new features had been added: operating system [MRDOS] release 03 under which FORTRAN release 05, FORTRAN V release 05, ALGOL release 06, and multi-user editor release 06 were supported; the BASIC job stream was added to its batch job processing capability, thus

further enhancing 140 system's run efficiency. To verify the reliability of the machine, all the test problems were repeated on an imported machine, i.e. NOVA 3, and the results were completely the same.

DJS-140 is one of the high-range models among the 100 series computers.

Its components are all Chinese-made TTL medium scale integrated circuits. Its chief hardware indexes are: basic word length 16 bits, maximum internal memory 128 K; memory period 1.2 microseconds, fixed-point arithmetic averages 800,000 operations per second; float point arithmetic averages 30,000-50,000 operations per second; 22 basic instructions; 14 basic extended instructions; 34 float-point instructions; 11 internal memory management and component protection instructions. The 140 machine passed the evaluation test and was approved for batch production. It will enrich and perfect the 100 series.

The representatives hope that Beijing Computer Plant No 3 will foster its achievements, further enhance system support work, improve quality, reduce cost, provide good technical support service, and further satisfy the users' demands.

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DJS-052II OPERATING SYSTEM EVALUATED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 5 May 81 pp 2,4

[Article: "DJS-052II Computer Operating System Compatible to CP/M"]

[Text] On 10-13 April, a DJS-052 evaluation conference was held in Nanjing and included the following sessions: "DJS-052I Microcomputer System Design Finalization Session," "DJS-052 Floppy Disk Operating System (FDOS) Technical Evaluation Session," "DJS-052II Hardware System Technical Evaluation Session." The conference approved the assessment and test reports presented by the joint survey group consisting of Qinghua University, Shanghai Computing Research Institute, and Automation Research Institute of the Academy of Sciences. The conference participants agreed that the performance of the DJS-052 computer was both stable and reliable, and the model was equipped with fairly complete software and hardware. The design of model I was finalized, and the conference endorsed the small-scale production of model II and popularization of the FDOS operating system.

Development of the DJS-052 microcomputer began in November 1978 in accordance with state plans. It was jointly designed by the Lanjing Aeronautical Institute [college] and Jiangsu Radio Plant, and it is produced by the latter. Both models I and II have the S-100 bus architecture, and the only differences between the two models lie in the peripheral control cards and peripheral configuration. Model I is currently used as a basic model equipped with photoelectric device, dot matrix printer and paper tape punch. By inserting a control card inside the case, it can be expanded into model II hardware system. Model II is basically equipped with the 052 mainframe, floppy disk drive, basic display unit, communication control keyboard, dot matrix printer. Based on their own needs, the users can add a number of optional external units and peripheral interfaces; audio (or digital) cassette drive, EPROM writer, X-Y plotters, A/D and D/A converters, digital I/O, IEEE 488 interface, CC-ITT interface, modulator/demodulator, etc. In software, the FDOS is a single-user operating system developed and transported by the Nanjing University, and there are currently three versions (052 FDOS versions 1.00, 1.02 and 1.04) which are compatible to Cromemco's CDOS, CP/M 1.3 and CP/M 1.4 respectively. Under the FDOS operating system, the 052 machine can run 10-odd utilities and language processing programs, such as conditional assembly language, compiler BASIC, FORTRAN, etc.

To provide the users with greater data reliability, the Jiangsu Radio Plant performs tests on 052 machines. The machines are subjected to 1,440 continuous hours of debugged trial runs. Subsequently, they are subjected to procedural tests, high temperature, low temperature, damp, vibration, impact, power voltage deviation, transportation tests, etc. Based on its performance in actual use by 10-odd users, the model has proven to be both stable and reliable.

The 052 system was developed consistently along the guideline of designing the hardware in accordance with the requirements of domestic production as well as the users' needs. At present, the components of the 052 computer are basically supplied by domestic sources; the 052I model is totally manufactured in this country. China now has the capacity to produce peripheral devices for the system, such as floppy disk drives, basic-type display units, dot matrix printers, which are characterized by high performance/cost ratio and have won excellent commendations from various concerned organizations.

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NEW 100 SERIES MODEL DJS132 SYSTEM DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 10, 20 May 81 p 4

[Article: "New 100 Series Model: DJS132 System"]

[Text] The DJS132 is the improved version of DJS130, and a mid-range model of the 100 family for popularization use. Its design was finalized in Tianjin in March 1981 (see CHINA COMPUTERWORLD, 3 Mar 81 p 12), and is currently batch produced by the Tianjin Electronics Instruments Plant, Shandong Weifang Computer Factory, and Suzhou Computer Factory.

Special emphasis is placed on the overall integration of DJS132's system structure, capability index, structural technology and reliability. The machine is characterized by good reliability, excellent system support capacity, and high performance/cost ratio; it is a multipurpose minicomputer suitable for batch production.

Fourteen kinds of peripherals were used during the finalization testing stage of the DJS132 system, including the following: cartridge disk unit, floppy disk drive, one-half inch magnetic tape drive, communication and multiplexer, console monitor typewriters 1 and 2, line printers 1 and 2, plotter, image display unit, paper tape input unit, paper tape output unit, and real-time clock. It will continue to support cassette drives, magnetic drums, communication control units and Fast Fourier Transform (FFT) devices.

DJS132-support software includes: three kinds of operating systems, i.e., SOS, XRTOS, RDOS; all kinds of high-level programming languages, e.g., FORTRAN IV, real-time FORTRAN IV, extended ALGOL-60, single user and multiple user extended BASIC, and various assembler programs. All of the preceding system software is debugged and operational, and the DJS132 system has proven capable of satisfying all the software requirements of the 100 series systems. Besides, it is also equipped with a "multiple peripheral reliability test package" which can conduct random testing of the system with programs that run under a simulated operating system.

The DJS132 comes with 24 basic instructions (hardware-implemented) which the 130 system does not have. The mainframe's fixed point addition/subtraction speed is 670,000 operations per second; its multiplication/division speed is 130,000 operations per second. DJS132 uses few components for such functions

as multiplication and division, automatic program bootstrap, internal storage write protection, and hardware diagnosis.

The 132 model currently employs magnetic core memory, 8 kilobytes single board, 1.5 seconds access time cycle; and plans are made to install 32 kilobytes single-board memory units.

For external data bus, the 132 model employs a duplex power gate driven bus which can support a maximum of 61 peripheral interfaces; it has two information transmission modes between the mainframe and peripherals, i.e., interrupt and direct data channels. The external interface board hardware can accommodate the DJS153 machine.

To ensure good reliability, the 132 model uses carefully selected medium and small scale integrated circuits produced in dual-in-line packages by China, as well as such new components as printed backplates and 100 line pin-type sockets, 50 line flat cables, and pierce-type plugs. New ideas have been incorporated into the machine both in structural design and technology.

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CSO: 4008/98

SHANGHAI'S FIRST DJS220 COMPUTER, EXTENDED FORTRAN TESTED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 14, 20 Jul 81 p 1

[Article: "Shanghai's First DJS220 Computer and Extended FORTRAN Pass Evaluation Tests"]

[Text] Entrusted by the State General Administration of Computer Industry, 10 organizations sponsored an appraisal meeting in May 1981 to evaluate Shanghai Computer Plant's first DJS220 machine, and the extended FORTRAN language jointly developed by Beijing University and Shanghai Computer Plant. The 10 organizations included Shanghai Computing Technology Research Institute, Huabei [North China] Computing Technology Research Institute, and the Computing Technology Institute of the Chinese Academy of Sciences.

The evaluation test for DJS220 consisted of the following two items: First, to test its parallel processing capability for supporting multiple channel/multiple equipment operations; a total of 31 activate-equipment test runs were conducted with no breakdowns or jitters, requiring only one startup. Second, to test the stability of the overall machine in serial operation; the tests also resulted in no breakdowns or jitters, requiring one startup only and 50 hours of stable run. After the evaluation tests, the computer continued to run over 50 hours with all kinds of equipment online.

Prior to its evaluation test, the extended FORTRAN language had already been used in 144 test problems, including 115 NBS FORTRAN test programs. A total of 18 formal test problems were tried on the compiler system, which consisted of the following two portions: First, emphasis was placed on testing its basic capabilities, using most of macro-instructions and related job instructions under the DJS22/XT1G operating system, and putting the machine through four job modes: direct-access single channel, single channel load job, single channel input, multiple channel input. Second, test the use of different types of files, interrupt/continuous processing, multiple target linking loader, and the main functions of its compile debugging and run debugging. The test results were all positive and proved that the extended FORTRAN language was of fairly good quality and had relatively strong capacities as well.

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IMPROVED VERSION OF DJS-6 DEVELOPED IN HUNAN

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 Sep 81 p 1

[Article: "Hunan Successfully Develops Improved Version of DJS-6 Computer: DJS-6-J"]

[Text] On the basis of the DJS-6 (108B) computer, the Hunan Province Radio Plant recently developed the DJS-6-J machine. Due to the extensive use of new components and new technologies, the size of this model is only one-third of the prototype machine while its speed has been increased nearly three times; its main memory has been expanded two or four times, and its system capability has been enhanced as well. It has passed the evaluation tests, and is approved for small volume production.

The DJS-6-J uses dual-in-line medium/small scale integrated circuit components, the main frequency has been increased to 2 MC; the main memory can reach as much as 128 kilobytes. Its access time cycle is reduced to 2 microseconds; and the machine can support up to eight peripherals. One of the characteristics of its design is the elimination of such auxiliary equipment as dedicated line transformer, intermediate frequency generator, and high-power air conditioning unit. Steps have been taken to enhance the machine's adaptability, and it can operate in 10-30 degrees Centigrade temperature environment, and run on 150-250 volts city power.

DJS-6-J's instruction system is compatible with that of 198B. It has altogether 64 operation codes, 4 classes of and 13 types of addressing modes; the software is compatible with the prototype machine, and the technical documentation is fairly complete.

The current price of this machine is approximately 400,000 yuan.

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DJS062 SERIES, NEW LSI COMPONENTS INTRODUCED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 20, 20 Oct 81 p 1

[Article: "Liaohe Experimental Research Institute Introduces Newly Developed Microcomputers and LSI Components"]

[Text] The Liaohe Experimental Research Institute organized a special evaluation meeting in Shenyang last September to introduce some of its research results. Twenty-six items were submitted for evaluation, including microcomputers and LSI components, most of which had reached national advanced level.

Among the various products, there were four microcomputer models, i.e., DJS062-A,B,C,D which were totally composed of LSI components developed and manufactured by the institute. Each model supports the following peripherals produced by the institute: CYD-1 and CYD-2 matrix printers, and CZX-1 and CZX-2 CRT display units, as well as cassette recorders available on the market. Models A, B and D are single-board machines; model C is a computer system configuration with such mainframe software as LOS-2 monitor program, resident assembler, resident counter-assembler, and BASIC interpreter. All four models have fairly strong capabilities and are easy to operate.

There were eight types of NMOS large scale integrated circuits which were tested during the evaluation: microprocessor unit MPU, asynchronous series communication interface ACIA, synchronous series data interface SSDA, parallel/general-use peripheral interface PIA, and 1 K static RAM, 8 K EPROM, 8 K ROM, and 128C x 7 x 5 character generator. New technologies and computer-aided board manufacturing techniques were extensively employed in producing the preceding parts, e.g., isopolar ionic implantation, LPCVD, parallel seam welding, dry etching, electron beam evaporation, etc., which produced high product-yield rates and excellent reliability. The products, moreover, are compatible with American-made M6800 parts.

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DJS-240, 260 PASS EVALUATION TESTS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 21, 5 Nov 81 p 1

[Article: "DJS-240 and 260 Passed Evaluation Tests"]

[Text] DJS-240 and 260 are medium and high grade models in the 200 family of computers, and are suitable for scientific computation, real time control and data processing. Designed by the 200 Series Joint Designing Group and manufactured by Huabei [North China] Computing Technology Research Institute, the first two 260 machines passed the evaluation tests on 11 August 1979, and have been delivered to users. The third and fourth 260 machines as well as the second and third 240 machines are now being assembled. Up to now, all four models in the 200 series, i.e., DJS-210, 220, 240 and 260, are available to users. The main frequency of the 240 model is 3.3 MC; the timing of various basic instructions falls within 0.6-6.6 microseconds; the machine has 187 instructions; the maximum capacity of its main memory is 32 K double word x 8; it has a total of 180 subchannels, and can support at most 240 I/O equipment. It supports a fairly complete range of peripherals. All system software is upward compatible and supports the DJS-200XT1, XT2, XT3 operating systems, the DJS-240/260 real time operating systems, DJS-200 supervisor, and all kinds of high level languages.

The 260 model's main frequency is 4 MC; the timing of its basic instructions falls within 0.25-3.75 microseconds; it is equipped with 187 instructions. The maximum capacity of its main memory is 32 K double word x 4; its channels, peripherals and software support are basically the same as the 240 model.

Chinese-made small scale integrated circuits are installed in the 200 series computers. Practical use has proven that Chinese-made integrated circuits are completely suitable for fairly stable medium and large frame computers. For example, when the first 240 machine was being assembled, a total of 53,150 components of 11 different varieties had to be tested and screened prior to the installation. Only a small number of circuit chips had to be replaced due to early failure; other than that, the machine has now run 6,000 hours with basically no component replacements. The machine was put to 150 hours of continuous running test, and manually stopped. The users are very satisfied with the stability of the 260 model.

To improve the mainframe speed of DJS-240 and 260, besides proper use of parallel operation and concurrent operation, a certain degree of high speed operation was used, e.g., 12 digital multiplication and iterative division in the 260 machine; 8 digital multiplication and iterative division in the 240 machine, etc. Moreover, the pipeline technique was used in the 260 model, and more than one-half of the instructions could complete preprocessing and processing within 250 nanoseconds. Thus, the average operation speed of DJS-260 exceeded 1 million operations per second, and the operation speed of 240 reached 500,000 operations per second.

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ZPC-2 FLOPPY DISK DRIVE PASSES EVALUATION TESTS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 12, 20 Jun 81 p 10

[Article: "ZPC-2 Floppy Disk Drive Passes Evaluation"]

[Text] Developed and manufactured by the Suzhou Electronics Equipment Plant in Jiangsu Province, the ZPC-2 8-inch single-side single-density floppy disk passed the evaluation tests at a design finalization meeting held last May in Suzhou.

The participants at the meeting agreed that as far as use and machine testing were concerned, the ZPC-2 floppy disk drive's work stability and reliability had reached the requirements for actual use, and the drive is compatible with IBM3740 format.

The ZPC-2 floppy disk drives use steel belts to move and position magnetic heads. This type of structure had been quite successful, i.e., it not only enhances the accuracy of positioning, but also increases the speed of allocation, thus resulting in excellent performance/cost ratio.

The magnetic head of the disk drive is up to the domestic advanced level in electric performance, smoothness and wearability, and the factory that produces the heads has solid technological basis. The Suzhou Electronic Equipment Plant is totally equipped with Chinese made devices and materials. The successful development of the ZPC-2 floppy disk drive is the result of combining learning from advanced foreign technology with tapping the factory's own creative force. It is also the result of disciplinary coordination.

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32 KILOBYTE CORE MEMORY MODULE PRODUCED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 12, 20 Jun 81 p 10

[Article: "32 Kilobyte Core Memory Module, Price Below 20,000 Yuan"]

[Text] The Shazhou Computer Plant in Jiangsu Province has developed and manufactured 2 microsecond 32 kilobyte core memory modules which passed evaluation tests conducted in Suzhou recently.

The participants at the evaluation session agreed that the core memory modules had excellent peripheral circuit design, reasonable and compact layout, and relatively good adaptability to environmental temperature. The low cost, in particular, won attention. The retail price is less than 20,000 yuan, and the performance/cost ratio is relatively high. The product should be popularized in all kinds of minicomputers. The read/write common-drive scheme of the module produces excellent results. This is China's first-ever success in using 16 K single sense-wire designing technique. The experiences are useful for designing medium speed large capacity core storage modules.

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MODEL 6500 COLOR GRAPHIC PRINTER DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 12, 20 Jun 81 p 10

[Article: "Color Graphic Printer"]

[Text] Xerox has announced the successful development of Model 6500 color graphic printer which reportedly uses laser scanning and dry printing techniques and can print color graphs within a few seconds. The output rate is 3.2 copies per minute for panchromatic graphs and 9 copies per minute for monochromatic graphs.

This type of printer belongs to the grate-scanning printer system which converts serial computer input data into color graphs at a resolution of 100 dots per inch. The maximum breadth of a graphic printout is 6.4 inches, and the length is 13.75 inches. The unit price is $30,000.

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HUNAN PRODUCES GTX-2 COLOR GRAPHIC DISPLAY UNITS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 14, 20 Jul 81 p 11

[Article: "GTX-2 Light-Pen Color Graphic Display Units"]

[Text] The GTX-2 color graphic display is one of the major scientific research projects in Hunan Province. Development of the system began in 1978 when the Changsha Engineering College undertook the design work and the Hunan Province Radio Plant carried out the trial manufacturing phase of the project.

The GTX-2 color graphic display is a complete intelligent terminal system composed of two major units: The control unit includes a DJS183 general-purpose versatile minicomputer equipped with such peripherals as hole puncher, paper tape input and punch controller. The computer serves both as the control unit of the GTX-2 color graphic display system and as an independent computing system for scientific computation and data processing. The graphic display unit is composed of CRT display, light pen, trace ball, keyboard and camera. Controlled by the DJS183 multipurpose computer, the color graphic display system features powerful graphic processing capabilities with the support of light pens, keyboards and trace balls; the system can display graphs and characters in four different colors with relatively high display rate. It is also equipped with a camera to photograph images on the screen. The display system is an ideal intelligent I/O device with complete functions.

Following are the chief technical characteristics of the system:

1. Control Unit

The DJS183 computer includes such features as single bus structure, hardware stack, multiple interrupt mosaic; clock frequency $\leqslant$ 500 nanoseconds; internal storage capacity 28 kilobytes (word length 16 bits) expansible; internal memory read/write period $<$ 2 microseconds.

2. Display Unit

CRT: Transmission-type 4-color display tube; effective display area; 26 cm x 26 cm; frame frequency: 50 Hz; display colors: red, orange, yellow and green; full-frame displayable vector length: 30 meters; full-frame displayable character set: 1,500-2,000 characters; generated character set: 96 ASCII characters; display unit clock frequency: 8 MHz; color switchover

time < 100 microseconds; brightness levels: very bright, bright, dark; light pen: computer-controlled tracing; viewing zone: 3 mm; keyboard: 52 character keys, 40 function keys, 12 operation keys; trace ball: outputs data on X, Y, Z coordinates, data in all three directions can be output separately or simultaneously; camera: manual-controlled or program-controlled picture taking modes.

On 4 March 1981, the Hunan Provincial Bureau of Electronics Industry jointly sponsored a GTX-2 evaluation meeting participated in by experts, professors, engineers and technicians from 20-odd organizations inside and outside the province.

Prior to the meeting, the Hunan Radio Plant and representatives from GTX-2 user organizations had conducted a test run which lasted for 100 consecutive hours without malfunction. During the meeting, the participants conducted a careful and comprehensive technical examination of the machine and unanimously reached the following conclusion: the GTX-2 color graphic display system is equipped with complete technical files; can clearly display 4-color graphic images; powerful anti-interference capability; excellent stability and reliability; meets strict technological requirements; aesthetically well-designed structure; all technical specifications meet design requirements and are up to the advanced level of domestically manufactured products of the same category. Equipped with all necessary functions and capabilities, the system is extensively used. In engineering design and scientific research work, it can be used as stand-alone equipment for such operations as graphic data processing and graphic display aided designing; it can also be used in any monitoring system which requires graphic displaying. In traffic control, it can be used for displaying on-the-spot vehicles and installations; the graphs are vivid and direct, which makes work easier for the traffic controller.

In order to further improve quality, reduce size and cut down cost, the Changsha Engineering College and Hunan Radio Plant have decided to replace DJS182 with DJS062 microprocessor as the control unit of the display system.

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1,000 MHZ HIGH-SPEED COUNTER TECHNOLOGICAL BREAKTHROUGH

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 13, 5 Jul 81 p 12

[Article: "Shanghai Radio Instrument Plant Achieves Breakthrough in 1,000 MHz High-Speed Counter Technology"]

[Text] High-speed electronic counters not only can measure a wide range of frequencies, but also random pulses. Moreover, on the basis of this high-speed technology, the upper limit of frequency measurement can be further extended. Thus, the development of high-speed electronic counters has already become a major aspect of the electronic counter field. At present, only a handful of countries have succeeded in breaking through this kind of technology.

Through over 1 year's effort using conventional printed circuit technology and discrete components, the Shanghai Radio Instrument Plant scored a breakthrough in the 1,000 MHz high-speed counter technology and developed the Aishi Brand S810-Type electronic counter of up to 1,000 MHz direct counting. This type of machine is characterized by the following features; wide frequency measurement range, high level of sensitivity, high speed, high level of precision, resolute display, stable and reliable, easy to operate, etc. The design was finalized in late 1980 when it won fairly good commendations.

The S810 electronic counter has the following characteristics--frequency measurement range: 10 Hz to 1,000 MHz; input channel impedance: 50 ohms and 1 megaohm; period measurement range: 1 microsecond to 10 seconds; frequency ratio measurement range: 10/1 to $1^{-1}/1$; frequency measurement sensitivity < 100 MV (rms), the sensitivity at frequency measurement range of 10 MHz to 1,000 MHz can be increased to 100 MV by adding on an S00001 Model high sensitivity amplifier; standard frequency: 5 MHz; daily frequency stability 5×10^{-9}; output voltage: > 0.5 V/1 kiloohm; daily base frequencies: 0.1, 1, 10, 100, 1,000 Hz; output voltage: 3V(P-P)/1 kiloohm. The counter also has reset input ports for outside connection and 1, 2, 4, 8 encoded outputs, which enables printing and logging of measurement results, as well as handling random tests in conjunction with the system. The factory has also conducted environmental tests on the machine, and the results have reached previously set technical targets.

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JINZHOU COMPUTER PLANT IMPROVING PRODUCT QUALITY

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 13, 5 Jul 81 p 3

[Article: "New Supply-Demand Relations Geared to User Needs; Jinzhou Computer Plant Takes Steps To Ensure Normal Operation"]

[Text] It has been almost 8 months since the Jinzhou Computer Plant delivered its product, the DJS140, to the Shandong Institute of Oceanography. To improve the quality of its products and expand the range of application, a meeting was held on 14-16 June at the Shandong Institute of Oceanography in Qingdao to evaluate the application performance of DJS140. At the meeting, representatives of the Institute of Oceanography gave introduction presentations on the selection, installation, as well as the application of their DJS140. Their presentation included an account of how they managed to set the entire system into normal operation in only 5 and a half hours after unpacking the machine. Their presentation was well received at the meeting.

The Jinzhou Computer Plant gave an outstanding presentation at the meeting. After introducing the characteristics of their product, they assured the users of their guaranteed products with the following solemn oath: All requests will be complied with and all questions will be answered and they will be on call at any hour and assume full responsibility. Actually, this was exactly how they had conducted business with the Institute of Oceanography. The representatives praised this kind of spirit and described it as a challenge to the current "bureaucratic business style." It is a new business style that deserves recommendation. This kind of business practice has won the confidence of the users. At the meeting several organizations expressed desire to discuss business with the manufacturer.

The DJS140 system produced by the Jinzhou Computer Plant has withstood thousands of hours of test runs; the machine quality has reached the domestic advanced level. It has been running normally for the past 8 months, and has processed a host of scientific research computation problems without a single hitch.

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DJS100 SERIES PRODUCTS EXHIBITED AT SALES SHOW

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 Sep 81 p 4

[Table: "100 Series Products Exhibited at Computer Sales Show"]

[Text] 100 Series Products at Computer Sales Show

Model	Chief Technical Specifications	Manufacturer(s)
DJS101	Word length: 16 bits Internal storage: 8-32 kilobytes Fixed point addition: 400,000 oper/sec	Science Education Instruments Plant of Huadong Normal Institute
DJS112	Word length: 16 bits Internal storage: 4-32 kilobytes (MOS or magnetic core Fixed point addition: 500,000 oper/sec	Shaoguan Radio Plant, Changzhou Radio Plant No 2
DJS130	Word length: 16 bits Internal storage: 32 kilobytes Fixed point addition: 500,000 oper/sec	Suzhou Computer Plant, Weifang Computer Plant, Beijing Computer Plant No 3 Tianjin Electronic Instruments Plant Tianjin Radio Plant No 2
DJS131	Word length: 16 bits Internal storage: 32 kilobytes Fixed point addition: 500,000 oper/sec Multiplication/division hardware, page protection units.	Shanghai Computer Plant
DJS132	Improved version of DJS130 with more capabilities/units: multiplication/division, automatic bootstrap, page protection, hardware self checking, odd-even checking; power drop protection automatic restart units	Tianjin Radio Technology Research Institute Tianjin Electronic Instruments Plant Suzhou Computer Plant

[continuation of Table]

Model	Chief Technical Specifications	Manufacturer(s)
DJS135	Reinforced structure; three protective measures; temperature range: -15 to 45°C; rest same as DJS130	Tianjin Radio Plant No 2 Yunnan Electronic Equipment Plant
DJS140	Word length: 16 bits Internal storage: 64-128 kilobytes Fixed point addition: 800,000 oper/sec Floating point (64 bits): 500,000 oper/sec Equipped with floating point unit, multiplication/division hardware, memory management protection unit, duplex machine and duplex work units	Beijing Computer Plant Jinzhou Computer Plant Liaoyuan Radio Plant No 3
DJS153	Word length: 16 bits Internal storage: 32-128 kilobytes Fixed point addition: 1-1.4 million oper/sec Floating point (64 bits): 500,000 oper/sec Equipped with floating point computation, memory supervisor protection, hardware stack, odd-even checking units; Two kinds of memory; magnetic core and MOS	Tianjin Radio Technology Research Institute Taiyuan Dazhong Machinery Plant Suzhou Computer Plant Weifang Computer Plant Tianjin Electronic Equipment Plant
DJS184	Word length: 16 bits Internal storage: 32-128 kilobytes Fixed point addition: 400,000-500,000 oper/sec Equipped with magnetic core and semiconductor memories which can be used together and furnished with memory supervisor and decimal system units	Huabei Computing Technology Research Institute
DJS185	Word length: 16 bits Internal storage: 32-124 kilobytes Fixed point addition: 500,000 oper/sec Equipped with magnetic core and semiconductor memories which can be used together; has floating point computation and internal storage supervision units	Shanghai Computer Plant

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SJ-77 COMPUTER SYSTEM FOR NETWORK COMMUNICATION

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 Sep 81 p 8

[Article by Liu Shanlin [0491 0810 2651], Shanghai Computing Technology Research Institute: "Characteristics of the SJ-77 Computer System"]

[Text] In accordance with the requirements of data processing application systems, the Shanghai Computing Research Institute has developed the SJ-77 computer, a data processing machine designed chiefly for real time processing to be used in network communication. Moreover, the mainframe has been innovated and expanded into the 77 series system. Emphasis is placed on application in the system design, especially the machine's instruction system, interrupt system, main memory management, input/output system, and communication control. Through debugging and evaluation, the system is found to have the following performance characteristics:

1. Multi-user/multi-job system: The system supports multiple work terminals; each unit is equipped with a keyboard display terminal or Type-55 typewriter terminal. The terminals can perform different jobs simultaneously, and can operate in foreground/background mode.

2. Equipped with communication control unit which supports several simultaneously-controlled speeds: The system's communication control unit can support terminals of varying baud rates. One communication control unit can control four baud rates: 50, 75, 100, 200; it can also control 16-channel half duplex or 8-channel full duplex communication lines.

3. Automatic reentrant routine: Can increase the utilization rate of the main memory and reduce I/O load.

4. Vectored Interrupt: The system provides 6-level automatic vectored interrupt and hardware protection and restore command; it can protect all kinds of contents according to the cause of various kinds of interruption, thus accelerating the handling of interruptions. The I/O system provides data chaining and command chaining functions for executing channel programs, thus improving the system's operation efficiency.

5. Independent I/O standard interfaces: Information can be directly put into or retrieved from the memory by the I/O standard interfaces without CPU intervention, thus enhancing the throughput of the overall system.

6. System expansibility: The modular structure of the internal memory and I/O enables flexibility in system support. The traditional I/O design has been modified to support various kinds of peripherals used by online users, thus furnishing users with possibility of expanding or renewing their own equipment.

7. Availability: String length modification instructions can be interrupted, thus enhancing system availability.

8. Reliability: The mainframe supports three kinds of modes, i.e., kernel mode, supervisor mode and problem mode, as well as eight circular protective levels; it also separates the spaces occupied by the instructions and data of each mode, thus preventing interprogram destruction. The internal memory provides Hamming-type verification; magnetic tape drives employ cyclic code checking method; data channels use byte odd-even checking method. Furthermore, the following technologies are also used for enhancing reliability: different kinds of matching, vibration elimination, filtering and printed circuit base board, etc.

SJ-77 series machines have 16 bit memory; the actual addressing capability of the main memory can be expanded to 256 kilobytes. At present, two types of models have been developed to 256 kilobytes. At present, two types of models have been developed: SJ-771 and SJ-773. The system is already being successfully applied in "artificial intelligence computer application systems for Chinese traditional medicine" and "inventory control application systems."

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TP80TS MICROCOMPUTER EDUCATIONAL EXPERIMENTATION SYSTEM

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 18, 20 Sep 81 p 7

[Article: "Beijing Industrial University Successfully Develops TP80TS Microcomputer Educational Experimentation System"]

[Text] Recently, to meet the need for experimentation courses in higher educational schools, the Microcomputer Teaching/Research Group in the Computer Department of Beijing Industrial University successfully developed and installed a microcomputer system for conducting educational experiments. The system's mainframe consists of TP801-Z80 single board computers produced by the Electronic Plant of Beijing Industrial University; it uses imported DIP standard socket boards and almost 30 imported IC chips designed for experimental work (including A/D, D/A converters, single chip sampler/maintainer, 2114 static RAM and some 74-series integrated circuits). With this type of system, it is possible to perform various basic experiments involved in logic circuit and microcomputer courses as well as basic experiments demonstrating the use of microcomputers in all kinds of automatic control systems. The Teaching/Research Group has now developed 10-odd experiment packages for the system, and compiled a set of teaching materials complete with detailed instruction on the experiments. The educational experimentation system not only meets the experimentation needs of college and university students who are taking related disciplinary courses, it is also of practical value to scientific research organizations as well as factories, mines and enterprises which require the application of microprocessors.

In an effort to solicit suggestions from various fraternal universities and colleges, the Beijing Industrial University will hold an evaluation meeting on campus on 26 September to finalize the prototype TP80TS educational experimentation system. Ten TP80TS systems will be exhibited at the meeting and the participants can use the systems to try all kinds of experiments. The experiment instruction materials will also be available for examination and revision. Other exhibits will include TP801 single board models and the prototype TP803 microcomputer jointly developed by Beijing Industrial University and the Hong Kong Jingye Company.

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GTX-A LIGHT PEN GRAPHIC DISPLAY DEVICE DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 18, 20 Sep 81 p 13

[Article: "Successful Development of GTX-A High-Speed Light Pen Graphic Display Device"]

[Text] The Automation Research Institute of the Chinese Academy of Sciences and Tianjin Radio Plant No 2 have developed and produced GTX-A high-speed light pen graphic display devices which use uniform speed analog lining technology. In August, an evaluation meeting was held in Tianjin. The GTX-A is suitable for displaying complicated diagrams used in computer-aided designing, control command centers, etc. It is useful for generating multi-quantum pattern mosaic as well as other kinds of man-machine interactive systems. With the exception of RAM, EPROM and computing amplifier, all the components of the GTX-A are produced in China. GTX-A has been successfully tied into DJS130 computer systems. The device has now reached the following targets: employs Chinese-made 43SS82D display tubes, 1024 x 1024 grating unit screen, can be expanded to upper semicircle and right semicircle, random scanning, 4-level brightness plus scintillation, frame frequency 30 mS; uniform velocity analog lining generator; point-to-point beam movement stabilization < 20 mS, the lining of each frame can reach 120 m, 3,000-6,000 short lines; 4 kinds of line patterns, 7 kinds of scales, 6 kinds of rotations; the character generator has the capability to produce 4 different fonts, 2 rotations, as well as superscripts and subscripts. Altogether, it can generate 242 different kinds of characters (English, Greek, numerals, letters, symbols and Chinese characters). It has 31 command systems, and such man-machine interactive means as light pen, keyboard, and coordinate locator. It is equipped with photoelectric device and audio cassette drive; the display unit's EPROM uses paper tapes or magnetic tapes as input/output means for program preparation; command memory debugging program; the light pen generates tracing programs and offline graphic processing programs. The uniform speed analog lining scheme adopted in GTX-A is the first of its kind in China, and its lining length can reach 120 m. At present, it is an advanced model among various computer graphic display systems in our country.

This type of display device will be produced on a small scale by Tianjin Radio Plant No 2.

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HUABEI TERMINAL EQUIPMENT COMPANY FOUNDED IN BAODING

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 21, 5 Nov 81 p 11

[Article: "Huabei Terminal Equipment Company Founded in Baoding"]

[Text] The Huabei [North China] Terminal Equipment Company was founded on 6 October in Baoding by incorporating the state-owned Jianshan Machinery Plant and Hebei's Baoding Electronic Instruments Plant. This particular joint venture between national and local enterprises was achieved on the principles of voluntary participation and mutual benefit. Li Rui [2621 3843], director of the State Computer Industry Administration, was present at the inauguration ceremony.

The Huabei Terminal Equipment Company is the first firm in China which specializes mainly in the production of computer terminals; it is well equipped and has relatively solid technical force with many years of experience in manufacturing computer peripherals. The establishment of the company is conducive to the serialization and specialization of terminal production, as well as the quality improvement and massive specialized production of its products.

The Huabei Terminal Equipment Company follows the system of job responsibility assumed by managers under the supervision of the board of directors. The company is composed of a Technical Development Division, a Production Planning Division, a Marketing/Support Service Division and a Treasury/Supply Division. The Technical Development Division will devote its efforts to designing and trial manufacturing new products as well as the development of technology in such areas as Chinese character intelligent terminals, all kinds of CRT display units, DJS060 series microcomputers and single board computers. The Marketing/Support Service Division will provide users with maintenance and technical training service.

Located in Baoding City, Hebei Province, the Huabei Terminal Equipment Company currently provides users with ZD-2000 Chinese character intelligent terminals, ZD-1110, ZD-1220 character display units, and MC6800 series single board machines.

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DJS132-3 MINICOMPUTER STRONGPOINTS OUTLINED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 22, 20 Nov 81 p 1

[Article: "DJS132-3 Minicomputer With Powerful Capabilities and Excellent Performance/Cost Ratio"]

[Text] Displayed at the National Computer Sales Show, the DJS132-3 computer won wide attention with its powerful capabilities and high performance/cost ratio.

The DJS132-3 model is the improved version of DJS130. It makes full use of the comprehensive and rich library of system software. Moreover, it has overcome DJS130's poor reliability and performance/ratio.

Thus, it not only has won excellent commendations from domestic users, but also the attention of foreign computer industrial circles. The head of the Japanese Overseas Information Prmotion Center's visiting delegation to China said: "The DJS132-3 minicomputer can compete in the international market."

The chief strongpoints of the DJS132-3 model are:

(1) Powerful hardware capabilities. Basic components include multiplication/division hardware, storage page protection, real-time clock, hardware diagnostic system for operational control and main storage. Besides the original three basic interfaces, a variety of additional interfaces have been installed for console monitor typewriter, wire printer, line printer, character display, plotter, etc.

(2) Excellent expansibility. The model employs standard bus organization, modular racks, modular cases and interface bus structure. It is basically equipped with such characteristics as optional plug-in units, optional plug-in positions, multiple case expansibility, and optional system expansibility. All of the above can be achieved without adding extra equipment.

(3) System hardware compatible with NOVA1200: Equipped with 40-odd diagnostic programs for hardware system checking, as well as rich library of software; also characterized by flexibility in operational use (has Assembler, BASIC, ALGOL, FORTRAN-IV, etc.); great variety of service programs which are economic and applicable.

(4) Excellent reliability: Equipped with U.S. standard SN74 series devices and internally optimized LSI components; supports optimized and reliable peripherals. Such new technologies as printed backplate wiring, computer-aided photo repeat, printed board negative lead-tin alloy plating, silk screen printing method of characters. The structural design is compact and reliable, which not only enables expansibility and maintainability, but also makes production and use easy.

High Performance/Cost Ratio: As described above, the DJS132-3 minicomputer has many characteristics; yet, it is also relatively low cost, which means better performance/cost ratio. This is exactly why it is widely well received.

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CHINESE CHARACTER DOT MATRIX TYPE BASE

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 22, 20 Nov 81 p 2

[Article by Lu Guangmao [1776 1684 2021]: "General Purpose Chinese Character Dot Matrix Type Base"]

[Text] In order to bring about computerized processing of information in Chinese characters, it is imperative to first develop a digital Chinese character type base. But this requires a tremendous amount of work; if various organizations engage themselves in such an undertaking, it will not only result in redundancy of efforts, but also poor compatibility and uniformity, thus causing the need for unification.

For this purpose, the State General Administration of Computer Industry summoned a meeting in Beijing last September to evaluate the 16 x 15 Chinese character dot matrix type. The meeting focused on the standardization of and typefaces for Chinese character dot matrix types, as well as rules for simplifying multiple-stroke characters. Special emphasis was placed on the representation of typical multiple-stroke characters of the 16 x 15 dot matrix type, and the establishment of standard character forms.

"The Chinese Character Dot Matrix Type Regulation" establishes the 16 x 15 and 24 x 22 dot matrix types as standard forms, and specifies the definition of dot matrix types and description of dot matrix type bytes. The character forms of the 24 x 22 dot matrix type are based on the Song [Dynasty] typeface, and are basically capable of representing words in the "Chinese Graphic Character Code Set for Information Interchange (Primary Set)." But due to the fact that the representation of each word requires an enormous amount of information for this particular type of dot matrix, the word library requires fairly large storage capacity. Thus, this type of dot matrix is used only for relatively high quality printing, such as the printing of formal files with wire printers for office file management, etc.

The character forms in the 16 x 15 dot matrix type are based on boldface type, and can represent the overwhelming majority of words in the "Chinese Graphic Character Code Set for Information Interchange (Primary Set)." As only a small amount of information volume is required for the representation of each word with this type of dot matrix, the word library requires smaller storage

and costs as well, which is suitable for popularization. Multiple-stroke Chinese characters can also be expressed through proper and minimal amount of simplification. "The Chinese Character Dot Matrix Type Regulation" establishes rules for the simplification of such characters of the 16 x 15 dot matrix type. It is suitable for such applications as business processing, inventory control, enterprise and business management, information retrieval, etc. It will not be long before the preceding standardized general-purpose Chinese character dot matrix types will be formerly released to users, and the software will be supplied in various forms for the users to choose from, i.e., ROM, punched tapes, floppy disks, etc.

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DEVELOPMENT OF DJS100 SERIES REVIEWED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 21, 5 Nov 81 pp 13, 14

[Article by Lu Wenchao [0712 2429 6389] and Chen Zhengqing [7115 2973 3237]: "Development of the DJS100 Computer Family"]

[Text] Since 1973 when our country decided to develop series computers, the growth of the DJS100 family has been fairly successful. The first DJS130 machine was evaluated in August 1974; up to now, nine different types of models of various sizes have been introduced into the DJS100 series. Moreover, some 700 machines have been produced and are currently in operational mode; they account for approximately one-fifth of the total number of computer machines in China, which is unprecedented in the entire history of the development of computers in our country. In retrospect, we are convinced that so long as our computer industry is developed in line with the actual conditions of this country, it will certainly grow and flourish. As this is exactly how the DJS100 series has been developed, it definitely holds bright prospects ahead.

Seven Years Development

The DJS130 model was first developed in 1973; following its evaluation tests in August 1974, Beijing, Tianjin, Shanghai, Jiangsu and Shandong began to produce this model, and within the short span of a few years, several hundred machines were produced and marketed. Although the DJS130 model was produced on a modest scale in the early period and its peripheral/software support was still incomplete, it was nevertheless an excellent beginning. Subsequently, the series began to develop towards the lower end of the DJS100 line: DJS110, 112, 102 and 101; along the same level as DJS130: DJS131, 132 and 135, as well as upwards: DJS140 and 153. By August 1979 when the DJS140 computer system was certified for production, the DJS100 series had already expanded into a complete family of computers. In 7 years time, tremendous progress had been achieved in all areas from component to mainframe, from peripheral to software, and from system to application.

The types of integrated circuits installed in the DJS130 model then were single or double gate flat packages; even single D-type flipflops and quadruple NAND gate circuits were all in the preliminary experimental stage. By the time DJS140 emerged on the drawing board, 10-odd medium scale integrated circuits (DIP) were employed, e.g., 4-digit arithmetic units, 4-digit shift

registers, 4-digit multiplexers, etc., and the degree of integration had been increased 4-10 times. Although it has taken quite some time to develop the devices, it is now possible to mass produce complete sets of high-quality medium scale integrated circuits, which is quite essential for ensuring the reliability of mainframes.

The mainframe of the DJS130 prototype model only had 16 kilobytes of internal memory. But its main memory went up to 64 kilobytes in no time. The reliability index of the DJS130 model in its early phase of production was evaluated at 50 hours; by 1980, the evaluated index was 500 hours. Now some factories can produce machines with reliability indexes up to 2,000 hours.

The central processing unit of the DJS140 model has its own multiplication/division hardware component as well as 64 bit double precision high-speed floating point unit (FPU); it has accuracy up to 15th effective decimal digit; its speed in floating point computation is 50,000 operations per second. It is also equipped with memory management paging unit (MMPU) for running multiple programs; the main memory is 128 kilobytes and expansible to 256 kilobytes. The mainframe of the DJS140 model is equivalent to approximately 2.5 times the scale of DJS130, and its scientific computation and real-time processing capabilities are vastly improved. In August 1979, when DJS140 underwent evaluation tests, the reliability index was 200 hours; recently, the reliability tests of factory products exceeded 1,000 hours.

The early DJS130 model machines did not have such peripherals as magnetic disk drives or 8 unit console typewriters, which affected software support. Both DJS140 and the recent model of DJS130 can basically support general-use peripherals. The recent version of DJS140, for example, can support 4 cartridge disk drives, 2 magnetic tape drives, 2 console terminals, 4 user terminals, 1 line printer, 1 plotter, 1 punch tape input unit, and 1 punch tape output unit, which is quite sizable in scale. Improvements have also been made in the quality and reliability of peripheral products. For instance, the exchangeability of magnetic tapes is now feasible and no longer a problem as it used to be for a long time in the past. The recent file exchanges between DJS140 and imported NOVA-3 machines were achieved through magnetic tape media.

In the early days, the software of DJS100 series used to reside in stand-alone punch tape systems, which, to a certain extent, limited the capabilities and application of the machines. In August 1979, the newly emerged DJS140 model had a complete set of system software with a disk operating system at the core. Subsequently, DJS130 and 131 were also upgraded with disk operating systems. Today, the DJS100 series has a rich library of softwares. For example, the DJS140 model is equipped with a very powerful MRDOS operating system, the latest version of real-time FORTRAN 5, real-time FORTRAN IV, ALGOL, BASIC and other high level languages; it also has editor, multiple user editor, assembler, macro assembler, batch processing and other utility programs. Not long ago, COBOL and PASCAL also became part of the software system which can now adequately support all kinds of needs for developing application programs.

Not long ago, some 60 problems were used to run comparison tests of the operating systems of DJS140 and NOVA-3 as well as their capabilities to support

programming languages. The computation results on both machines were exactly the same, and the speeds were basically 1:1.2. The hardware and software support of both machines were basically identical. This showed that the gap between minicomputers produced in China and foreign countries was gradually reducing.

Urgent Tasks

The hardware/software support of the DJS100 series is now fairly complete, and the mainframe stability has been improved considerably. Under such circumstances, emphasis should be placed on improving the entire system's reliability and resistance to interference, and enhancing the entire system's restoration capability in the event of malfunction, thus advancing towards the major goal of quality improvement.

In recent years, China's computer industry has had some setbacks in production, although it has strong potentialities. The marketing of computer products, moreover, also suffered from losses. This is directly attributed to the lack of extensive computer application in China as well as limited markets and high prices. On the one hand, there is an urgent need to consolidate bases which have been achieved thus far, improve the quality of products, lower costs, and enhance the performance/cost ratio of products; on the other hand, it is also imperative to popularize computers and open up new fields of computer application. The foregoing two tasks are linked to each other, but special emphasis should be placed on the former in order to facilitate the development of the entire computer enterprise.

(1) Multi-Terminal Computer Training Systems

Schools of higher education should set up multiple terminal computer training systems so that students can have the opportunity to take computing courses and take up design work projects as part of their course and graduation assignments. The faculty, moreover, will also have the opportunity to apply computers in scientific research work. This is especially important for training top-quality construction personnel and the popularizing computer application. Last year, the Zhengzhou Engineering College developed a DJS130 multi-terminal computer teaching system which attracted wide attention among various organizations. In other parts of the world, some economically developed countries have established four major targets for gauging the level of universities and colleges, i.e., computer, teaching force, library and laboratory, which merits our attention. Today, DJS130 and 131 training systems, as well as the DJS101 training system which is even more inexpensive, have been developed in this country. We are also currently in the process of setting up a DJS140 training system which will have even more powerful capabilities, i.e., besides multiple-user BASIC, it will also support multiple editing and batch processing programs; users can simultaneously enter and edit any kind of source language through their terminals, and the operating system can perform batch processing. This way, students will not only be able to learn BASIC, but also master the operating system and other high level languages.

At present, schools of higher education are inadequately funded, the state and concerned departments should take certain preferential measures (including payment by installments) to encourage them to use computers.

(2) Engineering Computers and Scientific Computing Systems

As large frame machines are fairly expensive in our country, quite a few organizations cannot afford to purchase such equipment. This is where the DJS100 series can play a useful role in facilitating the use of engineering and scientific computer systems. The upper end of the DJS100 series, in particular, are equipped with high speed and high precision floating point computation components, as well as highly optimized compiled programs written in FORTRAN-5. The machines have expansible internal memories and can take on fairly sizable computation problems. At present, DJS100 series manufacturers are trying to develop array processors; the installment of array processors in minicomputers will greatly enhance computing capabilities; moreover, their costs will be much lower than large frame machines. In view of actual conditions in China, minicomputers should have a relatively important place in the realm of engineering and scientific computation.

(3) Process Probing and Control Systems

Minicomputers are good at process probing and real time control, and they are extensively used for this purpose in other countries. In China, the relatively slow pace of development in this field is largely related to control targets, measurement and quality analysis instruments. Steps should be taken to energetically popularize computer probing systems and open-loop control systems by developing easy ones first and going on to difficult ones later, and moving from key points to all areas, thus gradually developing both in depth and scope. At present, computers should be extensively used for typical applications in energy and light industrial sectors.

(4) Medical Treatment and Diagnosis Systems

The use of minicomputers for medical treatment and diagnosis is quite popular in foreign countries. This type of application has caught the interest and attention of many organizations and departments in our country, and preliminary results have been achieved. For example, Beijing Computer Plant No 3 and Beijing Chinese Traditional Medicine Hospital jointly developed a "DJS130 multiple terminal medical treatment and diagnosis system based on information from eminent doctors of Chinese traditional medicine." The software package incorporates the rich experiences of two famous doctors of Chinese traditional medicine, i.e., the treatment/diagnosis of hepatitis by Professor Guan Youbo [7070 1635 3134], and the treatment/diagnosis of vascular diseases by Professor Fang Zhixuan [2075 5347 5503]. Some results have been achieved in the clinical application of this system. Besides, desired results have also been achieved by the Shanghai Tumor Hospital and Shanghai Computer Plant in using the DJS131 machine for tumor radio therapy applications, and by the Wuhan Radio Research Institute in using the DJS112 machine for the diagnosis, prevention and cure of cardiovascular diseases. In sum, great efforts should be made in popularizing the preliminary results achieved in the medical application of DJS100 series.

(5) Economic and Office Management Systems

The use of minicomputers in economic and office management systems enable factories and enterprises to bring about scientific management, fully exploit the production potentialities of enterprises, conserve energy, cut back material consumption, and improve work and production efficiency, thus attaining relatively good economic results. This type of minicomputer application should be energetically developed. There are already some pilot projects underway in the use of DJS100 series for enterprise management applications, e.g., Huadong Normal University is currently developing a DJS130 electronics enterprise management system for Nanjing Radio Factory; Beijing Computer Plant No 3 is developing a DJS130 enterprise management system for Beijing Television Equipment Factory. To facilitate this kind of development, steps should be taken to enhance the capabilities of DJS100 series which can be used for this type of application, such as the COBOL language, and BASIC language designed for commercial applications. Some concerned organizations and experts are developing database software for the DJS100 series.

Other applications include communication systems, plotting systems, automatic typesetting systems, information retrieval systems, picture information processing systems, aided designing systems, traffic and communication management systems, etc., which should be developed in depth, used on a wider scale, and popularized.

While setting up application systems, emphasis should be placed on collaboration among user organizations, manufacturers and research organizations. First, computer equipment manufacturers should collaborate with user organizations. This is because the former is usually familiar with its own products and not with the user, while the latter is exactly the other way around. Thus the two should combine their efforts, make up each other's deficiencies, and thereby accomplish the computer application part of project. Institutions of higher education and research organizations should also devote some time and effort on computer application research work, so as to offset the tendency of focusing their research efforts solely on the machine development and neglecting application; they should make themselves available to the needs of users and manufacturers. All three should concert their efforts in opening up the realm of computer applications.

Over the past 10 odd years, the computer enterprise has developed very rapidly in the United States, Japan and European countries. Moreover, the extent of computer application has been growing wider and wider with each passing day. Generally, there are several tens of thousands to several hundreds of thousands of computers in these countries. In our country, there are only some 3,000 computers in current use, and the extent of application is very limited. Many new application realms await to be opened. China's computer application has just begun to unfold itself; the task is heavy and the road ahead is long.

Future Goals

The traditional minicomputers are tailored for multiple-job small-scale operations which require a high degree of reliability at low costs. The speed and main memory capacity of the processors are not emphasized too much here.

Highly reliable and highly integrated components are generally used for the refined hardware system, and rich software libraries are used for perfecting the system's capabilities.

The continuous improvement and growth of computer technology and application level will gradually reveal the following weaknesses of traditional minicomputers:

(1) Small word capacity (16 bits) restricts logical space of user's program, and affects precision of computation.

(2) Slow speed cannot meet the requirements of large-scale computation problems or high-speed real-time processing; and at the same time also affects the response time of multiple-user timesharing terminal system.

Although the preceding deficiencies can be overcome with large frame machines, it is also possible to overcome them with distributed multi-minicomputer systems and super minicomputers while retaining the original strongpoints of minicomputers at the same time. We believe that the following unique developments will be achieved in the DJS100 series:

1. Distributed minicomputer multi-level system, i.e., multiprocessor systems and multicomputer systems with dispersed capabilities.

(1) Distributed multiprocessor systems include the following types of processors:

Job processor--the host computer of the entire system--runs general processing jobs.

Floating point processor--devoted to high speed floating point computation.

Array processor--specializes in matrix and such high speed computations as Fourier transform, loop filtering, polynomial multiplication and convolution.

Peripheral processor--handles all slow speed word processing equipment and multiple user terminals.

Other specialized processors can be developed, e.g., processors for high level language compilation, etc.

The floating point processor (FPP), array processor (AP) and peripheral processor (IOP) can be linked into a satellite processor/host processor configuration using their own local internal storages while sharing the same internal storage with the host processor. They all have their own special capabilities which are integrated into a single system under the overall scheduling of the operating system. This type of system is cheaper but even more reliable than large frame machines; in certain types of scientific computation and information processing applications, their performance compares favorably with large frame machines.

(2) Distributed multicomputer systems are composed of several or 10-odd minicomputers; the minicomputers are usually of the same type, but different types of minicomputers can be configured into the system as well. Each minicomputer has its own independent operating system to manage its own hardware/software resources for running a certain task. Communication is maintained among the minicomputers while one or two units can be assigned to the task of monitoring and overall scheduling.

In sum, while the minicomputers are dispersed in performing their own special capabilities, they are also coordinated as one system in performing large-scale complicated tasks.

This type of configuration is suitable for large-scale multiparameter, multiobject and multitask control and management systems. In comparison with large frame machines, multiple minicomputer systems configured on the basis of high reliability and low cost have the advantages of easy to maintain, easy to expand, excellent redundancy, and very economical. In foreign countries, there are many examples of the use of such configurations in high energy accelerator control systems, large-scale steel plant control/management systems, etc.

In China, research on parallel multilevel systems designed for high-speed computation is part of the research on large frame machine architecture. But, 3-5 years from now, there will be more and more applications in China using dispersed multiminicomputer systems.

2. A 32-Bit Super Minicomputer System

In recent years, 32-bit super minicomputers have been pouring into the market and selling like "hot cakes" by competing firms in the United States. It is the inevitable result of the ever-increasing performance/cost ratios of minicomputers and the ever-rising technical level of users. There is bound to be a breakthrough in the traditional minicomputer architecture. Many effective large frame system designing ideas will be introduced into minicomputers, and this kind of trend is sure to produce some kind of influence in China. Digital Equipment's VAX-11/780, Data General's MV/8000 and Prime Company's PRIME 850 machines have arrested our attention. But we should guard against wholesale import of "fashionable" products (though it is necessary to import a small number of machines for reference use). We should build up our strength, step up research, and try to come up with our own super minicomputers within 3-5 years.

As China's DJS100 series minicomputers have fairly sound basis, it is best to develop super minicomputers along the DJS100 line, but with the following characteristics:

1. Retain the strongpoints of traditional minicomputers, i.e., low price, high level of reliability.

2. Develop hardware and software technologies that are compatible to the DJS100 series so that current 16-bit machine users will not be unfamiliar [with 32-bit technologies] when they switch over to the new type of computers.

3. Capabilities should compare favorably with 32-bit large frame series.

As 32-bit machines have greater word capacity and greater logical space, the main memory should generally be the several megabytes, and highly integrated MOS memory should be adopted. Virtual memory and high-speed buffer techniques should be introduced into multilevel storage systems; high-speed logical components, high-speed pipeline, and distributed processing architecture will greatly increase processing speed; peripheral processors and high-speed external channels should be configured into the system to increase information input/output throughput; the response time of timesharing systems supporting several tens of user terminals should be ensured as much as possible.

3. Microminiaturization of DJS100 Series Machines

The emergence of large-scale integrated circuits in our country is bound to lead to the microminiaturization of the DJS100 series. As current DJS100 series machines already have a broad foundation, the microminiaturization of this family of computers plus the compatibility of hardware/software technologies will certainly bring a lot of conveniences to the users. Thus, the microminiaturization of the DJS100 series is a certainty.

The DJS101 model developed and manufactured by the Science Education Instruments Plant of Huadong Normal University is microminiaturized in technological structure using minicomputer units and techniques. The extensive use of this type of computers will open up markets for future microminiaturized DJS100 series machines. At the moment, the most important thing is to have semiconductor plants take up research and development of IC components for 16-bit minicomputers in the DJS100 series, and build a solid foundation.

These are the three goals for future work; we should start research and development along these lines and move on to a new peak.

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PROPOSED DEVELOPMENT OF BIT SLICE MICROPROCESSORS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81 p 3

[Article by Wang Jingchun [3769 2529 2504]: "Suggestions on Developing Bit Slice Microprocessors"]

[Text] The introduction of microprocessors in the 1970's touched off a revolution in digital systems. At present, our country attaches great importance to the development, manufacturing and application of monolithic microprocessors. We have been moving forward in this area at high speed, which is quite encouraging. But, it appears that not enough attention is being paid to developing bit slice microprocessors.

Bit slice microprocessors are computer systems composed of LSI bit-slice type microprocessors. Some people do not regard "bit slices" as microprocessors, but rather as parts. Thus, "bit slice microprocessrs" is an abbreviated term for computer systems composed of LSI bit slice parts. My reasons for suggesting developing bit slice microprocessors are as follows:

1. At present, there are quite a few organizations in our country that are developing computers for their own special applications (i.e., 'special purpose computers'). As the result of each organization making its own equipment, computers of all descriptions with no standardization whatsoever have been produced. Moreover, such research and development projects are very costly in terms of time and money. It is very worthwhile to find out how to solve this problem. The development of general-purpose computer series is, of course, our main direction; it is also an inevitable trend in computer development. But based on actual conditions in our country, it is also important to pay attention to developing microprocessors for special needs, e.g., applications which require highly reliable computers with environmental adaptability; computers that can perform high speed real time processing but are not large frame machines at all; computers that can meet special hardware big length requirements, etc. From the standpoint of proper selection of computers, it is not economical to choose general purpose machines which have more functions and capabilities than what is actually needed. From the standpoint of environmental adaptability, it is not easy to find a general purpose machine that can meet the requirements. Conversely, bit slice microcomputers are particularly strong in these two areas. With the use of bit slice cascade connection, it is possible to produce computer word lengths tailored to special requirements;

high speed requirements can be met by the use of low-power Schottky TTL (though ECL circuit can reach higher speeds, they are heavy power consumers; from the standpoint of developing microcomputers and minicomputers, the author suggests that priority should be given to the development of low-power Schottky TTL bit slices). In light of the current technical and technological levels in our country, it is also relatively easier to develop bit slice architecture which can meet strict environmental adaptability requirements.

2. Compared with computers composed of monolithic microprocessors, the chief drawback of bit slice microprocessors lies in the lack of unified instruction sets on macro-instruction level; hence, software development is somewhat limited, which is inconvenient for users. The author holds that this drawback should be approached from the analytical point of view, i.e., the weakpoint of bit slice microprocessors is attributed to its strongpoint--flexibility. We should thus maximize its strongpoint and minimize its weak point by making maximum use of its "special purpose" capability. In China, there are quite a few small organizations which produce computers. They are usually staffed with software and hardware personnel, and are thus in a position to overcome such difficulties. Through the research and development of bit slice microprocessors, it is possible to organize them and gradually move towards standardization. As the chief functional parts of bit slice microprocessors are at least standardized, it is not necessary for each organization to develop its own logic design from scratch. Thus, hardware should be standardized to the greatest possible extent. By loading PROM (or ROM) with suitable contents, it is possible to meet special purpose requirements. In software development, through coordination and mutual help, it is possible to unify and standardize those components which can be unified and standardized, and gradually develop those software which should be developed. This will greatly reduce time and cost needed for research and development, and moreover, help gradually bring about serialization and standardization. In sum, through bit slice development, it is possible to lead these organizations from the path of developing computers "single-handed" to the path of "cooperative transformation." Of course, for those who can use monolithic microprocessors (commonly known as microcomputers), it is not necessary to go into bit slice technology.

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INTERCHANGEABLE DISK STORAGE SUCCESSFULLY PRODUCED IN CHINA

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 3, 14 Feb 81 p 11

[Article: "Interchangeable 6-Drive Disk Storage Successfully Developed in China"]

[Text] In fulfillment of the task assigned by the Shanghai Science and Technology Commission, the Science and Education Instrument Factory of the Huadong Normal University, Gexin Plastic Factory, Huangpu Instrument Plant and Huadong Computing Research Institute jointly developed an interchangeable 6-drive disk storage, and successfully concluded the assembly and debugging phase of the project in June 1980. The disk storage passed a series of test runs which lasted for a fairly long period of time. In December 1980, the Shanghai Science and Technology Commission sponsored a technical evaluation meeting to conduct an all around evaluation of the prototype model which included both technical and economic ratings.

Chief technical specifications of the disk storage are: total capacity 7.25 megabytes; track density 4 tracks/mm; bit density 44 bits/mm; average access time 50 ms.

The prototype disk storage was subjected to 50 hours of continuous operating test without any failure, using the diagnostic and reliability test programs of the DJS100 series disk drive control unit. Besides, a series of performance tests were conducted to check protective function, power source fluctuation, anti-interference, etc. The prototype model worked normally throughout the entire test stage. The evaluation group members unanimously agreed that all the technical specifications had met designed requirements, and the performance of the model was stable and reliable, thus completely qualifying for online work in computer systems. In light of the urgent demand for mainframe support, the evaluation group expressed hope that all aspects of the production and technical preparation work would be carried out to bring about trial production as soon as possible.

Disk storages are indispensable peripherals to modern large-frame computer systems. Compared with magnetic drums and tapes, they have large capacitance with quick access. But China is still lagging way behind in disk technology; it still lacks the capacity to produce this type of equipment and meet the urgent needs of mainframe development. This is due to the fact that this type of production involves high-level precision, high degree of difficulty in

manufacturing, and many kinds of new techniques and technologies as well as basic industrial support which our country does not have yet. We already have the capacity to produce large mainframes with computing capabilities up to 1 million operations per second. But without large capacity disk storage, it is impossible to make the best use of them--they can only be regarded as equivalents of fully configured foreign-made minicomputers. The production and popularization of computers in China have been gravely affected by the current state of backwardness, which, in turn has affected the progress of the "Four Modernizations" program.

The successful development of the interchangeable disk storage indicates that China has achieved remarkable improvements in the development and production of disk storages. For the first time, we have successfully produced disk drives which use magnetic head positioning systems with voice coil linear motor drives. The disk coating technology and read/write performance of disk heads have improved; the recording density has been increased four times; the average access time is nearly 10 times faster than the same type of products produced in this country in the past. As the disk packs are manufactured in accordance with internal standardized ISO-2864 specifications and incorporates DJS100 series general-use interfaces as well, the interchangeability and standardization of the disk storage units have been enhanced, which is immensely helpful to manufacturers and users.

The Shanghai Science and Technology Commission received excellent commendations from the participants at the evaluation meeting for sponsoring the joint disk research and development project. They praised the committee for adhering to the policy of self-reliance especially at a time when importing had become a "vogue" in our country and there was a growing desire to introduce disk production lines from foreign countries. Disk technology is characterized by a high degree of difficulty involving a wide range of disciplines. Based on this characteristic, the committee made good use of Shanghai's superior science and technology resources. In accordance with the principle of large-scale socialist cooperation, it broke down the barriers between various industries by mobilizing and organizing related sectors in the local area to jointly tackle key technical problems involving basic components and special equipment required for manufacturing disk storage units, thus providing the basis for producing such components and equipment independently. The preceding manner in which related scientific research organizations and factories in the city were organized into a concerted disk research and development force constitutes an effective means of speeding up disk technology development.

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DJS051, DJS052AD3 SYSTEMS OUTLINED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 4, 28 Feb 81 pp 1,2

[Article: DJS051 and DJS052AD3 Systems Made in China"]

[Text] The Anhui Provincial Science and Technology Commission and Anhui Electronics Bureau jointly sponsored a conference in December 1980 to evaluate the DJS051 and DJS052AD3 microcomputer systems developed by Anhui Electronics Research Intitute. Some 30 representatives from 16 organizations participated in the meeting, during which there were technical reports on the DJS051 and DJS052AD3 systems, and the newly developed prototype DJS040 (Z80); all kinds of demonstrations were organized at the meeting as well. The evaluation group conducted various kinds of online tests on the 051 and 052 systems which proved to be of excellent reliability and accuracy.

Both systems received fairly high commendations from the representatives who agreed that the models were "successfully designed" and had "use values worth popularizing."

Made in China

The DJS051 model uses four or five CPU chips jointly produced by Anhui Electronics Research Institute and Shanghai Radio Plant No 14. Besides the storage units which temporarily rely on imports, the other devices are all produced in this country. The LSI device of DJS052AD3 are Intel 8080 series products; its TTL units are basically made in China.

Peripherals include 8-inch floppy disks, 80 x 24 CRT character display units and audio cassette storage, which are designed and manufactured independently by the same organization. The systems also support Chinese-made printers (Beijing Computer Plant No 4 produces 80-column thermal printers; Qianxian Plant in Nanjing produces 132-column dot matrix printers), photoelectric input units (Jianghuai Plant in Hefei); hole punchers (Qingdao Miniature-electric Generator); they are also equipped with EPROM writers.

Software includes mini-operating system MOS, intelligent face board operating system AKOS, monitor programs CRT edit programs, Assembler language system. Magnetic disk operating system ADOS and extended BASIC will be available soon.

All of the preceding systems adopt standardized modular designs in accordance with the requirements of the State Computer Industry Administration. The internal bus is S-100, the peripherals use RS-232 serial interfaces, and 8-bit parallel interfaces, so as to accommodate Chinese and foreign-made compatible modular boards and peripherals, which adds convenience to users of various fields. Each modular board in the system has capabilities that are relatively integral and integrated; the users can dismantle any of the modular boards according to his needs, and organize economic and proper applicative systems of suitable scale. The smallest system, DJS-052A, only requires two S-100 modem boards, (each board measures 10" by 5") and the price is very low.

Characteristics of DJS052A

1. Intelligent Face Board IFP--Hardware consists of small 20-key keyboard and 6 light-emitting diode (LED) indicators; software consists of AKOS (ANHUI KEY OPERATING SYSTEM). AKOS has capacity of 3 kilobytes and very powerful capabilities. Besides displaying and loading memories, registers and I/O interfaces separately or serially, it can also exercise simple control over inputs from keyboards, punched tapes, cassette tapes and floppy disks, and output to CRT display units, printers, cassette tapes, paper tapes and floppy disks; it also has EPROM programming ability. Moreover, it can retain user defined commands to enable certain applications to execute process control through IFP instead of I/O equipment or system software, which is very effective for minimizing system cost, simplifying user techniques and popularizing computer application.

2. Mini-operating System MOS--Includes monitoring, editing and assembler; powerful capabilities; easy to use; depends on minimal sources for required hardware components, the smallest system only needs a TTY or CRT; MOS capacity is under 6 kilobytes.

3. CRT display unit--Composed of 12-inch television screen and two S-100 modules. As the display buffer storage and mainframe are linked through a standard S-100 bus and constitute a portion of the main memory, the manufacturing cost of the entire display unit is very low (manufacturing cost basically consists of the two module boards); moreover, the unit is designed for general use and can be easily hooked up to any system with S-100. The display system is synchronous and characterized by excellent resolution and stability.

4. Floppy disk RCP 20-II 8-inch disk; single side; single density; capacity: 3.1 M bits; transmission rate: 250 kilobits/second; access time: 10 mS; average latency: 83 mS. Main technical indexes have reached the same level as products of the same category produced in foreign countries. The evaluation meeting concluded that it was suitable for "small-scale batch production on trial basis."

Characteristics of DJS051

The CPU of DJS051 is produced in China; its clock frequency is one times less than 8080; it outflanks the 8080 inspeed and convenience for application in the following two aspects:

Direct microprogramming control--In certain simple applications, five 051 CPU chips can be used for constructing a minimum system equivalent to a single-chip computer with ROM. Of course, it is also possible to add other components according to requirements for setting up a suitable system.

For applications that require high-speed response, the 051 model can respond in less time sampling units and can therefore offer even greater real-time processing speed.

For 16-bit arithmetic computation and block operation, besides extended microprogrammed 16-bit arithmetic instructions (including multiplication and division) and block operation instructions, the machine also has bit computational hardware which not only doubles the speed of this type of computation over the 8080, but also greatly simplifies the programming of application software.

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FEATURES OF 151-3/4 LARGE FRAME COMPUTER SYSTEMS OUTLINED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 5, 3 Mar 81 pp 1-2

[Article by Professor Ci Yungui [1964 0061 2710], Changjiang Engineering College: "Features of 151-3/4 Large Frame Computer Systems"]

[Text] 1. General

151-3/4 models are large frame general-purpose computer systems. The 151-3 (developed in 1977) is a monoprocessor system, while 151-4 (developed in 1979) is a dual-processor (or dual computer) system. They are designed for scientific research applications or engineering design computation, and can also be used for real time or nonreal time data processing. The main frequency is 3 MHz. The monoprocessor can execute 1.3 MIPS for 64-bit floating point operation and 2.5 MIPS for 32-bit floating point operation. The dual processor can execute 2.4 MIPS for 64-bit floating point operation, and 4.0 MIPS for 32-bit floating point operation. The machines have four types of instructions, i.e., L, B, D and Z, totaling 166 in all. The main memory is 256-512 kilobytes, which is installed for modulo-4 or modulo-8 cross access. The 153-3 has 64 channels; 153-4 has 128 channels. All kinds of standard interfaces are configured into the machines. They can support a fairly complete range of peripherals. All the units in the systems are made in China.

In order to increase operation speed, ensure high degree of reliability and system flexibility, a series of new technologies are used in the system design, e.g., look-ahead control with variable depth, streamline technology, fairly large instruction buffer-storages, multiple general registers, C registers, ultra-high speed automatic scheduling data buffers, plug-in main memories, error record registers, state registers, proper form-even and check-even layout, modulo-3 checking, modular structure, dynamic backup, automatic switchover into 6 system states and automatic switchover of large units, etc. Based on 1 year of actual runs, the systems have been proven to reach all (or exceeded some) of the predetermined design goals. Moreover, the runs were excellent all the way through, and the systems won high commendations.

2. Features of the System Structure

Duplex parts, modular structures as well as dynamic/static backup and automatic switching techniques are extensively used throughout the systems' overall structures and subsystem structures. The 151-4 is composed of two processor

modules (each includes two identical functional units, one-run control unit, one-instruction control unit, and six advance access registers and two late transmit registers and address code registers); eight main memory modules (8 x 32,000 words x 34 bits); two cache modules (2 x 256 words x 32 bits); two ultra-speed fixed storage modules (2 x 16,000 words x 32 bits) and two converter modules (each includes one information ministorage, one control word ministorage, one controller, scheduler, external interrupt generator and channel status word). These modules can automatically (through supervisor) or semi-automatically change the corresponding "0" or "1" of the system status word in accordance with the user's requirement and the working states of various major units, and thus convert the machine(s) to the following six different working states of the following four types of systems:

(1) Dual Computer System. The main memory works according to dual modulo-4. Processor 0 executes the program in the left modulo-4. Processor 1 executes the program in the right modulo-4. The two programs are completely identical. Two converters (each with 128 channels) are used together, and the channels serve as dynamic backups of each other.

(2) Dual Processor System. The main memory works according to module-8 or modulo-4, while the other modulo-4 serves as dynamic backup or is put under repair. The two converters are jointly used.

(3) Stand-alone Dual Computer System (Dual Monoprocessor System). The main memory works according to dual modulo-4. The two converters are used together. But the 128 channels are divided into two separate groups through program scheduling: The first group (e.g. odd channels) serve the first monoprocessor, and the second group (e.g. even channels) serves the second monoprocessor).

(4) Stand-alone Monoprocessor System (or Monoprocessor Modulo-4 Dynamic Backup System). The main memory works according to modulo-4; the two converters are used jointly. The other processor and the other modulo-4 memory are either dynamic backups or under repair.

The preceding six kinds of working states of four types of computer systems are basically formed from flip-flop states directly controlled by the status words in the control memory, which is simple, economical and easy to realize. Moreover, some of the states are formed spontaneously after removing malfunction units. The entire system is a kind of self-adapting variable structural system which has automatic switchover and automatic organizing capabilities.

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DJS130 MULTI-USER SERVICE SYSTEM

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 12, 20 Jun 81 p 8

[Article: "Remarkable Results Achieved in Kaifeng City's DJS130 Multi-User Service Center"]

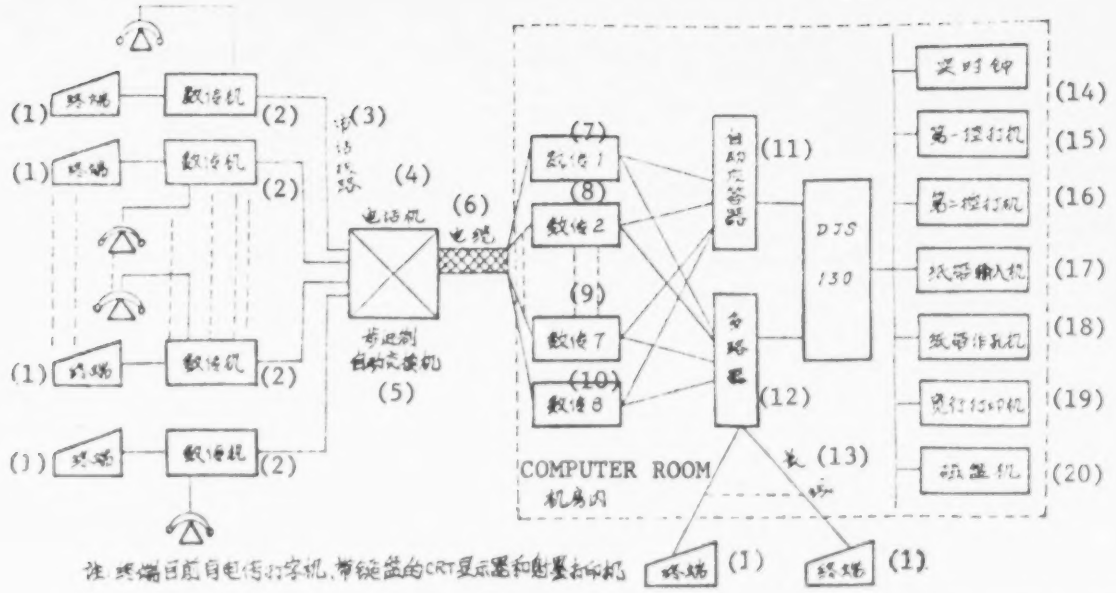
[Text] Kaifeng City's DJS130 multi-user service system was recently evaluated by the State Computer Industry Administration and Henan Provincial Science and Technology Committee. The system was developed by Kaifeng Computer Technology Research Institute with the help of Zhengzhou Engineering College and Kaifeng Municipal Bureau of Post and Telecommunications. With the DJS130 machine at its core, the time-sharing system supports remote terminals (ranging from several to 10-odd kilometers away) through the local telephone network, and performs scientific calculations and data processing. The time-sharing system with one host computer and multiple terminals is still in the infancy stage of a computer network, but it can be used under existing local telephone network conditions. The current configuration of the system is shown in the diagram below.

Besides currently-available 100 series software, the system is also configured with extended multi-user BASIC interpreter system, exchangeable BASIC system under RDOS, and a library of application programs.

Performance indexes of the system:

Communication mode:	Full duplex
Synchronous mode:	Synchronous start/stop character
Transmission speed:	$\leqslant$300 bauds
Characters:	5 units or 8 units
Busy bit error rate:	$\leqslant 10^{-5}$
Number of terminal channels:	12 (expansible to 32)

Since its trial use in 1979, the system has been serving dozens of organizations in the city and other parts of the province, and long-distance telephone terminals have been set up in eight organizations including the Urban Construction Committee, Electric Motor Plant, and Hospital No 3. Excellent results have been achieved so far, and all user organizations are satisfied with the performance of the system. Here are some examples:



Note: Terminals currently include teletype units, CRT display units with keyboards, and ink jet printers

Key:

1. terminal
2. data set
3. local telephone lines
4. telephone set
5. step-by-step automatic telephone system
6. cables
7. data set No 1
8. data set No 2
9. data set No 7
10. data set No 8
11. automatic answering equipment
12. multiplexer
13. long lines
14. real time clock
15. console typewriter No 1
16. console typewriter No 2
17. punched tape reader
18. paper tape puncher
19. wide column printer
20. magnetic disk drive

1. User: Henan Province Agricultural Region Planning Office

Applications: Process data on agricultural resources throughout the whole province. The 170,000 primary data and 500,000 result data have been entered; 22 target items, such as cultivated area, yield, etc., covering over 2,000 communes, have been compared and sorted.

Result: Fast and reliable statistical computation. Used to lag behind in reporting statistical figures to the State Council; now it ranks among the forefront.

2. User: Kaifeng City College Entrance Examination Board

Application: Statistical computation and sorting of examination scores of 8,000-9,000 examinees.

Results: Finished statistical computation and registration of all college examination scores in only a week's time, completely replacing manual work.

User: Hospital No 3 of Kaifeng City

Application: Introduced hepatitis diagnosis/treatment software based on the experiences of Guan Youbo [7070 1635 3134], a well-known doctor of Chinese traditional medicine.

Result: Remarkable results have been achieved over the past year in the diagnosis and treatment of over 400 cases in the province and city. For example, an 80-year-old female patient had suffered from ascites for 3 years and could not be cured by many doctors. After medical treatment based on the diagnosis performed by the software, the ascites was remedied, and the patient regained her health.

4. User: Kaifeng Urban Construction Committee's Office of Design Work

Application: Civil engineering computation.

Result: In the past, the computation had to be done in Shanghai or other major cities, wasting manpower and money in the process. Today, computation can be performed on the spot; moreover, a fairly large number of optional plans are produced for optimum design.

5. User: Kaifeng Electric Motor Plant

Application: Designing the electromagnetic layout of medium and small size squirrel-cage motors of 40 different specifications.

Results: Manual computation for this type of design work used to be time consuming, which not only delayed conclusion of contract negotiations with prospective customers, but also caused such predicaments as standstills in factory operations, etc. With computer-aided designing, computations based on user requirements can be completed on the same day. Recently, thanks to the speed and accuracy in computation, the motor plant managed to win several hundred thousand yuan worth of customer orders in the competition against 10-odd manufacturers.

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DJS100 LOGIC SIMULATOR DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 8, 20 Apr 81 p 7

[Article: "DJS100 Series Logic Simulator"]

[Text] Developed by the Chengdu Telecommunications Engineering Institute [College], the logic simulator is an application software designed for the DJS100 computer series, and remarkable results have been achieved by such users as Institute of Photoelectric Technology under the Chinese Academy of Sciences.

The logic simulator is used for testing logical designs of digital circuits before the actual circuits are installed; it is also used for evaluating logic schemes and obtaining detailed information on circuit activity. This is a concrete example of the application of computer-aided design technology in logic designing.

This is the first time China has successfully developed a logic simulation language for minicomputers. Specifications and characteristics are as follows:

1. A gate level hardware descriptive language (known as "LM-1 language" for short) is designed to include two major parts: (1) Component statements for describing basic logic circuits composed of such components as AND gates, OR gates, NOT gates, NAND gates, NOR gates, AND-OR-NOT gates, exclusive NOR gates as well as flip-flops and JK flip-flops. (2) Command statements which enable the simulator to provide certain functions with the necessary action parameters. The syntax of the statements is simple, easy to understand, easy to read, easy to write, and suitable for popularization.

2. Simulation System: Characterized by use of tabular input format when entering source statements for building internal models. The system is also equipped with a waveform generator statement which creates a group of 3-valued input waveforms to activate 3-valued signal transmission inside the circuit, thus causing the component processing subroutine to operate on 3-valued truth tables.

3. Test Result Output System: The simulation results are output in the form waveform graphs on teleprinters or line printers, and the actions of 20 components can be observed at the same time. The output waveforms are clear and direct, and easy to analyze.

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PORTABLE DIGITAL LOGIC EXPERIMENT EQUIPMENT DEVELOPED AT NANJING UNIVERSITY

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 13, 5 Jul 81 p 2

[Article by Lin Xinyuan [2651 0207 0337]: "Nanjing University's Computer Science Department Successfully Develops New Type of Digital Logic Experiment Equipment"]

[Text] Circuit and logic experimentation constitutes an extremely important part in computer science education. It is not only a means of teaching students about circuits and logic, but an important means of enabling students to acquire a certain amount of skill for conducting experiments as well as ability to perform practical work, which helps to prepare the students for work after graduating from school in the future. Thus, circuit and logic experimentation is also an important means for teaching students how to combine theory with practice. However, our circuit and logic experiment equipment was still at the level of the 1960's. Moreover, our experimentation skills were backward, and we achieved very little results at high costs. Faced with the rapid growth of the computer enterprise, the broad ranks of faculty and staff in our department resolved to change the face of the laboratory. To achieve this, we did a great deal of reading, visited several universities in the country to exchange experiences on the teaching of experimentation courses, and conducted a fairly extensive investigation and study as well. The problem was discussed at the Symposium on Experimentation Work in Computer Education convened at the request of the 1979 National Compucer Annual Conference. The participants at the symposium agreed on the urgency of developing general purpose experimentation equipment adaptable to LSI, MSI and SSI. Our department's digital logic laboratory workers undertook the task of developing a new type of digital logic experiment equipment. With the cooperation of some factories, it took them over half a year's effort to come up with trial-produced SJB-46 experiment breadboards and DLB-1 logic experiment boxes.

The SJB-46 breadboard (currently batch produced by Jiangsu's Wujin Xian Radio Components Plant) is an expansible multisocket board with 46 lines. This type of board is very popular in foreign countries and easy to process. It has 23 rows of socket holes on either side; each row has 5 interlinked socket holes. The distances between the holes are designed according to distances between external lead wires of standard dual-in-line IC packages, thus making it possible to accommodate all kinds of SSI, MSI and SSI in standard dual-in-line packages, as well as other kinds of electronic components and conductors with 0.5 mm leads. The chief specifications of this type of breadboard have

reached the same level as foreign made products of the same category. The DEC-1 experiment box is manufactured by the Xu City Electronic Equipment Plant in Jiangsu Province's Changshu County. The box is equipped with 12 SJB-46 experiment breadboards, 5 Volt (1A)/10 Volt (0.1A) dual voltage DC voltage-stabilized power supply, countable logic pen and low-frequency pulse injection pen, 8 LED indicators with drives, 2 seven-segment displays with decimal decoders, 8 logic switches and 1 single-pulse button switch. The experiment box is not only designed for digital circuit and logic design experiments, it can also be used for conducting experiments on simple microprocessor systems as well as expanded experiments on single-board microcomputers. The box also comes equipped with simple tools and spare circuit boards, and can be conveniently used for performing experiments any time any place. Thus, it is also referred to as "portable lab." In other countries, quite a few univerisites and colleges furnish their students with similar equipment for this kind of experimentation course, and the equipment is well received by students and instructors. Our Computer Science Department has already begun to use this type of experiment equipment in digital and logic designing experimentation classes. Practical results indicate that SJB-46 experiment breadboards and DLB-1 digital logic experiment boxes have the following advantages in the teaching of experimentation courses:

1. Less waste: In the past, IC components had to be soldered onto printed circuit boards for each experiment. The parts and printed circuit boards become useless after the experiment, and new parts have to be purchased for the next experiment. Now, it is possible to use the integrated circuits and parts over and over again, which greatly reduces experiment costs.

2. Save time: In the past, students had to assemble circuits with soldering irons in order to perform such experiments. As mistakes or poor soldering often happen, it was necessary to check the circuits numerous times before they could be used for the experiments. Now, there is no need for soldering as the IC circuits and components can be inserted into the breadboards. Moreover, even if mistakes occur in line connections, they can be corrected quite easily. This way, it is possible to save one-half or two-thirds of the time needed for conducting such experiments.

3. Wide use: The logic experiment box is not only useful for experimenting with all kinds of logic circuits, it can also be used for fairly large-scale combination experiments and microprocessor experiments, which are conducive to the development of scientific experimentation.

4. Convenient: The experiment box is compact and equipped with voltage-stabilized power supply and such functional testing devices as logic pen and pulse pen, as well as functional tools and integrated circuits. It can be used in any place that has AC power lines.

Over the past half year, besides digital logic experimentation courses, the faculty and students of Nanjing University's Computer Science Department have also successfully performed the following medium-scale experiments with this type of equipment: making Chinese character keyboards, dynamic memory devices (MOS RAM), D/A converters. With this type of experiment box, they have combined education with scientific research, thus giving impetus to the development of education and scientific research.

SJB-46 experiment breadboards and DLB-1 digital logic experiment boxes are used all over the country in many provincial and city institutions of higher education, scientific research organizations and concerned factories, mines and enterprises, which goes to show that they are not only suitable for experimentation courses in the educational field, but also for circuit building and experimentation in scientific research. We are confident that they will contribute to the modernization of circuit experimentation.

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PHOTOELECTRIC TAPE READERS TYPES, FEATURES REVIEWED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81 p 11

[Article by Wen Jianchun [3306 1696 2504], Yantai Radio Plant No 2: "How To Properly Select Photoelectric Tape Readers"]

[Text] Computer users are all quite familiar with photoelectric tape readers as every computer system is configured with one--they are inseparable as body and shadow. But some users may not necessarily know anything about the various types and features of this kind of equipment. We often come across such strange and lopsided situations as a huge photoelectric reader hooked onto a small minicomputer. There are also small photoelectric readers placed next to large frame computers, like a tiny horse pulling a giant cart. These examples show that quite a few users lack adequate understanding of the types and features of photoelectric readers, and their choices are consequently inappropriate and irrational, thus causing a lot of problems in operational use.

To properly choose photoelectric readers, one must first of all get a basic understanding of this type of equipment.

Photoelectric readers are roughly divided into three types according to size: large, medium and small. Generally, they are classified according to the following three aspects: (1) external size; (2) number of functions; (3) read tape speed. Large photoelectric readers generally come in large sizes with fairly complete capabilities, fast reading speed of approximately over 900-hole columns per second; some are equipped with two interchangeable tape transport-read units; some are equipped with manual interrupt, tape break, tape end, ready, and other interfaces, as well as adjustable light emission circuit. RDG-8, RDG-9 and RDG-16 fall in this category of photoelectric readers. Small photoelectric readers are generally relatively small in size, equipped with one kind of function, and low price; but their reading speed is relatively slow--less than 200 hole-columns per second, such as the RDG-10 model. Medium frame photoelectric readers fall between large and small machines; they come in moderate sizes with several simple functions; the reading speed is generally approximately 200-hole columns per second. RDG-5, RDG-6 and RDG-7 models fall in this line of photoelectric equipment.

In most large frame models, the paper tape is transported by means of a drive wheel motor in conjunction with a tape advance wheel; the tape take-up and

release spools are stopped by the combined action of the motor brake and magnet-driven belt. In most medium and small size photoelectric readers, the paper tape is transported by means of a drive wheel motor in conjunction with a tape advance wheel, and the tape is stopped by a pressure block controlled by an electromagnet; some models control the tape start/stop mechanism by means of a step motor in conjunction with sprocket holes in the gear wheel. The step motor is controlled by circuit which constitutes the start/stop mechanism of the paper tape transport system.

Besides, there are two kinds of start/stop transportation mechanisms: slow start/stop and fast start/stop. Most early models do not have the fast start/stop feature. For reading program tapes, there are inertia gaps for the spools on both ends of the paper tapes; in some program tapes, gaps are also planted in places along the tape for the machine to stop. These types of machines are slow start/stop models. In recent years, some computer systems require enhanced overall performance which calls for fast start/stop photoelectric readers; i.e., each time the computer sends out a start command for advancing one hole column, the photoelectric unit reads in one hole column of information, and the brake distance is less than 1 mm. In other words, each time the computer sends out a stop command, the photoelectric reader has to overcome the inertia of the tape spool so that the tape stops between the finished column and front border of the next column, thus ensuring the next start-and-read session without missing any of the holes in the process. This way, there is no need for inertia gaps in the program tapes. When real-time DOS programs came into use, computers set even higher requirements on the fast start/stop performance of photoelectric readers which had to be equipped with random reset function as well.

Thus, the proper selection and use of photoelectric readers should be based on the requirements of a particular computer model. This enables users to make rational purchasing decisions on suitable kinds of equipment and good use of available resources.

Following are some examples:

(1) If the tape programs are lengthy and entail large volumes of input but with no fast start/stop requirements, it is advisable to consider such large-frame slow start/stop models as RDG-8 and RDG-9. The characteristics of RDG-8 lie in the absence of photoelectric amplifier and other interfaces, which are suitable for computers equipped with photoelectric amplifying units and do not have special interface requirements. RDG-9 models are equipped with manual interrupt signal, tape break signal, tape and signal and ready signal interface lines; its photoelectric amplifying unit is adjustable; it is well equipped with electrical equipment and functions, and it can transmit standard signals directly into computers. It is the high-speed version of RDG-8.

(2) If the tape programs are lengthy and entail large input volumes with fast start/stop requirements, the RDG-16 photoelectric reader is a good choice. Besides all the electrical performances of the RDG-9 model, the RDG-16 photoelectric reader comes with fast start/stop functions and photoelectric current/voltage indicators; it is fully equipped with various functions and

capabilities, and is easy to operate. The preceding three types of photoelectric readers are mostly used to support large and medium computers.

(3) If the tape programs are of medium input volume and require fast start/stop functions, RDG-5, 6 or 7 models would be excellent choices for medium and small frame computers. The RDG-5 is characterized by simple circuits, more mechanical units, and maintenance and adjustments are required for the mechanical parts when the machine is used over a long period of time. But the price is low. RDG-7 and 7 models have more circuits, simple mechanical units, and generally require no adjustments or servicing when used over a long period of time. But the prices are higher than model 5.

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SOFTWARE INDUSTRY DEVELOPMENT LOOKED AT

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 3, 14 Feb 81 p 3

[Article by Li Weiyi [2621 4850 4135], Taizhou Electronics Research Institute, Jiangsu Province: "The Key To Developing Software Industry Lies in Tapping Potential Resources"]

[Text] After reading the article "Software Industry Should Take the Lead" in issue No 3, 1980, I pondered over the author's words "Let software take the key role; let software lead hardware; let software serve hardware." This is really a brilliant idea which conforms not only to the actual conditions in our country, i.e., large population, backward economy, and the immense difficulty of popularizing computers within a short period of time, but also to the current economic adjustment guidelines, i.e., reduce number of projects which draw heavily on capital resources, and increase the number of projects which rely heavily on manpower resources.

Then how to develop our software industry? Although we should definitely vigorously train and foster a new force, in my opinion, the key to software industry lies in tapping potential forces. On the basis of fully and properly exploiting the current software resources, we should gradually expand the contingent and set up all kinds of software factories (including neighborhood-run factories).

Although the software development force in our country is still quite weak, it has nonetheless initially grown to a considerable size. The main problem now is that it has not been properly or effectively organized. The software production is still in a state of scattered "small-scale peasant farming." Redundant work and nonstandardized products can be found everywhere. Specialized production is even worse; no matter how big or small a system is, almost everyone has to share full responsibility, i.e., from overall designing to flowcharting, programming and debugging; senior software specialists and engineers are also involved in programming. The use of such resources is extremely irrational. The distribution of work is likewise irrational. Large projects are mostly assigned to large and well-known organizations, while small and unknown organizations stand no chance at all irrespective of how resourceful they may be. As a result, some organizations are overladen with work while others have practically nothing to do at all. Consequently, large organizations often delay projects due to overburdening tasks, while software people in smaller

organizations are either forced to idle away time or change professions altogether. It is said that there are quite a few software people who are underworked, which means there is still quite a large potential force to be tapped. In foreign countries, programmers are most urgently needed whereas some of our software people with over 10 years of working experience have not had any projects to work on for a long time. There is no way of getting assignments, and there is no way of getting transferred to places where work is available--can we allow this situation to continue?

The waste of human resources is the greatest waste of all. I believe that earnest, proper and effective efforts should be made to organize the currently available software people in our country as soon as possible, establish a centralized business assignment system, and greatly promote specialization, standardization and unification in production. The scattered software resources should be relatively concentrated. Is it possible to set up regional software centers in the northeastern, northern, western, southwestern, eastern and southern parts of China, and have each software center set up all kinds of software factories, and software service firms which will provide software to both China and foreign countries? If so, the productivity of software business is bound to double and redouble, and the technical level will also improve rapidly.

On the basis of the results achieved in tapping potential resources, and in accordance with actual needs, we should gradually broaden the contingent of software workers and build a mighty force which will help change the backward state of our country's software industry.

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DIGITAL IMAGE CRT SUCCESSFULLY DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 13, 5 Jul 81 p 11

[Article: "Digital Image Display Terminal Successfully Developed"]

[Text] The Image Processing Group of Qinghua University's Radio Department completed their research project on "Type-I Digital Image Display Terminal" in a little over 2 years' time. The performance specifications of the machine has reached national advanced level, and are comparable to foreign-made 1978 models of the same category.

The Type-I Digital Display Terminal is characterized by the following four main functions: (1) memory capacity: can store 256 x 256 x 11 bits of picture information; (2) window real-time processing capability: can retrieve and display any gray-shade portion from the image's 2048 tonal grades, which is a highly efficient means of image enhancement and feature retrieval; (3) false coloring real-time processing capability: use of different colors to represent various gray shades, thus converting a gray-tonal image into a (false) color image, the purpose of which is to enhance image display results; (4) image-and-character superimposed display capability: for captions, the keyboard can be used to type in characters anywhere in the picture.

The Type-I Digital Display Terminal can be configured into DJS130 or DJS140 systems to form interactive image processing setups. It has interface circuits for the DJS100 series; the image refreshing memory is 4 K RAM; and it is equipped with 20-inch color monitor and 12-inch black-and-white display unit. The R&D group is currently developing a Type-II Image Computer Display Terminal with enhanced processing capabilities.

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COMPUTER APPLICATION IN MACHINERY PROCESSING INDUSTRY

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81 p 9

[Article: "A Concrete Example of Computer Application in Machinery Processing Industry"]

[Text] This article introduces a method for computing the adjustment cards of spiral bevel gear machine tools.

The spiral bevel gear machine tool is an automatic lathe. Prior to the cutting of spiral bevel gears, the worker has to make appropriate adjustments on the machine tool according to the data on the lathe adjustment card. The card data is usually computed manually, spending as much as 6-7 hours, and frequently with errors, thus affecting the quality of the spiral bevel gears.

In other countries, the Gleason spiral bevel gear machine tool produced by an American firm uses computers to complete the adjustment card data. The meshing spots processed according to the computer-punched cards are fairly ideal.

The Computer Application Division of the Shanghai Machine Tool Research Institute believes that one of the most urgent problems which needs to be solved now is the replacement of manual computation with computers in order to liberate technicians from tedious computation work and eliminate human error in calculation. A computer program has now been developed in BASIC language for this purpose.

The software is based on Ketrinsky's rules of adjustment computation. Instead of looking up tables, the polynomial adaptive optimization method is used for obtaining and processing height deflection coefficients and tangential deflection coefficients. Likewise, other types of data are obtained through continuous logic decision processing on the computer. As manual table checking has been replaced by the computer, it is possible to produce all the card data instantaneously by merely entering 10-odd items of primary data into the computer through teletypewriters.

The computer program is suitable for the following five types of domestically produced machine tools: Y2212, Y2225, Y2235, Y2250 and Y2280. With the aid of computer-punched data cards, satisfactory results have been achieved in machine tool processing.

The application of computers in production and providing computer service to the machine processing trade should not be overlooked in the drive to popularize computers.

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COMPUTER USE IN DESIGNING, MACHINING

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 4, 28 Feb 81 p 8

[Article by Zhang Shaohua [4545 1421 5478], Computing Technology Research Institute, Zhejiang Province Science and Technology Commission: "Computer Aided Designing Used in Cam Designing, Plotting and Machining"]

[Text] Cams are indispensable control parts used in automation by all branches of industry. From sewing machines and wristwatches used in daily life to mechanical hands and robots in industrial automation, cams constitute a vital part for controlling all kinds of actions and movements. Although cams appear to be small and bumpy parts, they are not so easy to design at all. It is extremely difficult to design a high precision cam which meets all kinds of requirements. Designing cams by applying the "analytical method" or "graphic method" according to mechanical principles is not only time consuming--often taking up many weeks, but also impossible to meet the designing requirements or precision. This problem has never been properly solved as it involves complex mathematical models, complicated and tedious computations. The blueprints, moreover, are difficult to draw, and it is naturally even more difficult to machine them with any degree of precision.

Computers Can Solve the Difficult Problem

We have explored ways of using computer-aided methods for designing, plotting and machining this difficult but useful machinery part. Furthermore, we have succeeded in achieving a higher degree of automation in cam designing with the help of computers. In collaboration with Associate Professor Xu Zhenhua [1776 2182 5478] of Zhejiang University's Department of Mechanical Engineering on a joint project to develop an "oil motor stator curve modeling cam" for Zhejiang University's Dongfanghong Machinery Factory, we plotted cam contour diagrams with the help of computer-aided designing technique, and punched program paper tapes for numerical control machine tools. Both the dimensions and precision of the products were in complete agreement with the specific requirements, and the technique is now employed in actual production. This completely justifies the feasibility of the use of computer-aided techniques for designing, plotting and machining cams. We also compared noncomputer-aided designing against computer-aided designing. Without the computer, calculation and plotting alone (not including machining) took up 2 weeks, and the degree of precision was not satisfactory at all. Now, with the aid of

computers, it takes only 3 minutes to complete the designing, computation, plotting and machining data for the numerical control lathe, and the degree of precision has been greatly improved. Besides the preceding project, we also conducted simulating the designing and plotting of various typical kinds of cams, and the results were all quite satisfactory too. With computers, it is also possible to modify unsatisfactory portions of the design any number of times until all of the user's requirements are met.

Analyzing, Classifying and Developing Software

There are many different kinds of cams. According to the contact elements between moving members and cams, the latter can be classified into sharp top, roller and flat base types. According to the movements of moving members, cams can be classified into shift and rocker types. According to the relative installed positions between the moving members and cams, the latter can be classified into centering and eccentric types. Based on the types of mechanism alone, one can find several tens of different kinds of cams. If computations and designing are conducted directly on the computer without mathematical processing, one would not only waste a great deal of computer time, but also end up with useless results. Thus, we have reclassified the preceding several tens of types of cams into the following four broad types based on mechanism:

(1) cams of roller/shift driven members
(2) cams of flat base/shift driven members
(3) cams of roller/rocker driven members
(4) cams of flat base/rocker driven members

Based on dynamics, we have also produced a universal parametric expression for the preceding four types of cams using the envelope method in differential geometry as well as direct geometric methods.

Based on the parametric equations, we drafted charts directly using the stratified drafting method with implicit parameters of derived functions. In the course of drafting, the user can instantaneously find out if the cam design satisfies the designer's requirements or whether there are any problems in the designer's blueprint. It is also possible to modify the base radius and various parameters through the console keyboard or photoelectric reader; the modifications can be performed repeatedly on the computer until the user is satisfied. If the computer is configured with a visual display unit, modifications can be done on the screen with a light pen. When the designer is satisfied with the results, the computer can output the data of all the coordinates for him. If there is need for direct online to the wire cutting numerical control lathe, all that has to be done is to turn the preceding designing, computing and cam drafting software into a subroutine which can be called from the wire cutting program, and the output punched tape can be immediately applied to the wire cutting lathe without going through other processing. The radii of various kinds of machined molybdenum wires used in the wire cutting lathe are all included in the design, thus ensuring the precision of the machined cams.

In the original software, the movement pattern equation for designing a given cam had to be supplied by the user, which was very inconvenient to the user; sometimes, the user is confronted with problems which cannot be solved at all. To solve this contradiction, we improved the software. A series of frequently used movement pattern equations have been developed, e.g., linear motion, uniform acceleration, uniform deceleration, cubic curve motion, sinusoidal acceleration, cosinusoidal acceleration, trapezoidal acceleration, etc. Also incorporated into the software are ways of ensuring the smoothness of nodes under all kinds of circumstances.

Now it is quite convenient for users to come up with cams according to his own specifications. He no longer has to supply the cam designer with various movement pattern equations. All he has to do is to describe the movement patterns of each section, e.g., linear motion in the first section, parabolic motion in the second section, etc. The rest is all taken care of by the computer which selects the appropriate movement equation and cam type, and computes and drafts the charts according to the user's description of the movement pattern. This greatly reduces the designer's workload, and liberates him from complex computation, designing and plotting work, thus greatly improving the speed and precision of designing as well as the degree of automation. After computation, designing, plotting, repeated modifications until satisfactory results are achieved; the computer prints out the data of all the coordinate points and plots the standard blueprint of the cam. If online production of the cam is required, a high speed tape puncher is used to punch tapes for the numerical control lathe, thus materializing online machining.

The computer-aided cam designing, plotting and machining methods described above are only attempts and practices which have to be further studied and improved in the future.

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COMPUTER USE IN SHIPBUILDING INDUSTRY REVIEWED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 28 Jan 81 p 8

[Article by Yuan Cunxian [0337 1317 6343] and Fan Jiebei [5400 4105 0271] of Shanghai Shipbuilding Technology Research Institute: "Fifteen Pears of Computer Application in Shipbuilding Industry"]

[Text] I. Introduction

In the early 1960's, with the rapid growth of computer technology, shipbuilding scholars and experts around the world became energetically involved in research on applying computer technology in shipbuilding. They have achieved remarkable economic results, and helped to accelerate the development of shipbuilding industry.

Under the influence of worldwide shipbuilding science and technology, we also became involved in this type of research in 1965, and have achieved fruitful results.

II. Main Work

In the past 15 years, we conducted extensive research on the application of computers in shipbuilding, striding forward towards the world's advanced level. The entire research project is broadly divided into the following three major stages.

(1) Exploratory research stage (1965-1969)

In the early 1960's, when we learned about the efforts of several advanced shipbuilding nations that were probing into the application of computer technology in shipbuilding and the breakthrough in fair mathematical ship lines, we immediately started joint research with fraternal units on mathematical ship line fairness and plank mathematics. Thanks to the initial success achieved in an experimental fishing vessel project of Jiangnan Shipyard, we came to understand that computer application in shipbuilding was an important direction for future growth in shipbuilding technology.

To speed up research work, in 1969, we purchased the first X-2 computer for the shipbuilding system, and the computer went into operational mode in 1970. It turned out to be immensely helpful for the initial stage of the research work.

2. "System" Program Module Research Stage (1970-1976)

In the early 1970's, computer application in shipbuilding entered a new stage when all kinds of shipbuilding integrated circuit systems (abbreviated to "system") emerged one after another, which helped to strengthen our confidence in research. We studied and went abroad to survey the major contents of advanced "systems" of the world. With special emphasis on lofting, setting plank seams (?), and plank development, we tackled key problems and achieved one breakthrough after another.

Due to the in-depth development of our research, in 1974, we replaced the original computer model with a Chinese-made DJS-8 medium frame computer which has a memory capacity of 64 kilobytes x 48 bits, average speed of approximately 240,000 operations per second, and simple I/O management. We also imported a large frame numerical controlled plotter, the technological level of which was that of the 1970's. These sets of equipment further accelerated our research work.

In 1974, with the support of concerned departments, we organized a research project on large-frame numerical controlled plotters. In 1975, a model was successfully developed, thus filling in a gap in China's shipbuilding and electronic industries. It is now mass produced by Shanghai Automation Instruments Plant No 2.

The importation and development of plotters have contributed to the development of our nation's software as well as plotting techniques.

Together with Zhejiang University, we were awarded at a science conference for attaining international level in our research on deflection lines and dual arc fitting. Another project which nearly reached international level was the DJS-8 ALGOL language developed in collaboration with a computer research institute.

Subsequently, in coordination with Zhejiang University, we developed the "one tape/multiple machine" and "multiple tape/one machine" methods and software which allow punched tapes of different kinds of machine coding to be interchangeable. This achievement has received excellent commendations from specialists in our country.

3. "System" Research Stage (1977-1979)

The prerequisites to our "system" research were:

(1) Installation of a DJS-8 medium frame computer configured with two drums and two magnetic tape drives which provided preliminary basis for developing a data base;

(2) Development of application program modules;

(3) Employment of hardware maintenance and software research specialists.

Drawing on experiences from other countries, we made overall plans. As we recognized the difficulties in developing a comprehensive shipbuilding system (SBS), a plan was formulated to develop a simple but feasible hull construction system (HCS). It took us over 1 year's effort before the HCS system was finally developed; it was the first "system" of its kind in our country which had reached international level. The entire "system" has 350,000 instructions; centered around a database, it runs under an operating system especially designed for shipbuilding.

Besides, we also have successfully developed other software systems, such as: ship designing integrated programs system (SDS), ship pipe integrated programs system (PCPS), graphic processing language (HCL), which also received excellent commendations at domestic and international technical exchange seminars.

To meet "system" requirements, we have exerted tremendous efforts in developing and improving hardware. We have solved the tape drive unstability problem, realized the online use of DJS-8 computer and the SM-4 plotter, developed dual processor communication software, and conducted experiments on using the DJS-8 computer for transmitting data via city power lines, thus laying the foundations for building a computer network.

III. Looking Ahead

The 1980's is an important decade for materializing the four modernizations. We are prepared to do the following three things: (1) On the basis of the HCS system, develop a large-scale SBS system incorporating our own special features; (2) purchase new computing equipment, set up a shipbuilding computing center, and develop software for shipbuilding; (3) energetically serve the exportation of ship products, shipbuilding technology and "system" technology.

We firmly believe that on the basis of the preceding three items, our technology will be elevated to an even higher level and make greater contributions to the shipbuilding industry.

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W91-III MINICOMPUTER PRODUCED FOR SHIPBORNE APPLICATIONS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 7, 5 Apr 81 p 1

[Article: "W91-III Shipborne Minicomputers Commercially Produced"]

[Text] W91-III machines are shipborne general-use minicomputers designed in China.

Based on its performance at the National Major Projects Test, the model has demonstrated such characteristics as stable and reliable performance, easy to operate and maintain, good environmental adaptability, excellent protective capabilities against humidity, salt corrosion, shock and vibration. It is a fairly good model for applications on ships and motor vehicles.

W91-III characteristics: 16-bit word length; fixed point, binary, complimentary and parallel operations; flexible modular structure tailored to the needs of various users with different scale requirements; adaptable to any type of peripherals with appropriate interface; suitable for scientific computations, experiments, real time control and testing; can be used as terminal of large frame computers.

The minicomputer has 2 MHz clock frequency; the work cycle of its 16-bit adder is 500 nanoseconds; its comprehensive computing speed is 200,000 operations per second. Besides instruction counters, it has four general-use registers which are also used as index registers. The model is equipped with 65 instructions, 3 interrupt levels and a duplex channel common bus structure.

Its magnetic core memory uses the 3-D 3-wiring coincident-current selection system. The read/write cycle is 1.6 microseconds. Including the check bit, the total word length measures 17 bits; the basic memory size is 16 K, and can be expanded to 64 K.

The interface's index registers have 4,096 addresses, which is quite adequate for the extensive needs of real time control and data processing.

Besides, the computer is also equipped with high-speed data channels and basic peripherals. For the convenience of users, it is configured with standard interface logic.

At present, the system is configured with the following software: supervisor, standard subroutines (for single-length, double-length, and triple-length primary functions), single-user BASIC, FORTRAN, Assembler, counter-assembler, and maintenance program.

In 1980, this model was used for the National Major Projects Test; it was awarded by a government department for its reliable performance in completing the task.

The model has already been approved for production.

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SUBWAY CENTRALIZED DISPATCHING COMPUTER DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 13, 7 Jul 81 p 12

[Article: "Centralized Dispatch Equipment Successfully Developed in Second Stage of Beijing Subway Project"]

[Text] The capital city's circular underground railway is now basically completed, and will be tied into the east-west subway line to form a network. To ensure the traffic safety of future subway trains, enhance transportation efficiency and reduce labor intensity, the Nanjing Wired Communications Plant has developed a centralized dispatch control system.

Controlled by a computer, the equipment can implement centralized dispatches and information displays with its remote control and telecommunication functions. It is chiefly composed of a console, d ta transmission unit, and logic unit which can be controlled either manually or by computer. When controlled by computer, the computer produces control command digital signals based on preprogrammed train dispatch programs; the signals are converted into audio-frequency continuous signals through a digital/analog converter; the latter is transmitted through the bottom cable to all subway stations which are linked to four bottom lines in parallel. On receiving the signals, the data transmission equipment of the stations converts them back into digital signals which are relayed to the logic units for processing; corresponding execution signals are generated and used for ordering corresponding relays into action through the centralized electric units which control the stations. The train-movement signals from the centralized electric units are then gathered by the stations into their logic devices for sampling and coding, and subsequently sent to the stations' data units to be converted into audio frequency continuous signals which are transmitted via the top cable back to the central station. The signals from the various stations are picked up by the central station's data transmission equipment, converted into digital signals, and sent to the logic device of the central station for processing. Subsequently, the processing results are transmitted to the computer and displayed on the display board.

The system uses a survey scanning method to gather all kinds of information regarding the control area of each station, i.e., it polls the stations one after another over and over again in a certain periodic cycle, and scans the entire area of each station. The repeated scanning of each bit of information greatly enhances the credibility of the information on the display board.

The equipment allows a dispatch center to cover 25 stations within the range of 40 kilometers; the stations are approximately 1.5 kilometers apart from each other. The system works on either one-way control or two-way control from the dispatch center.

One outstanding feature of the equipment lies in the use of 1,200 bytes/second phase modulated data transmission technique in remote control and telecommunications systems, and the transformation of the 1:1 operation mode to a 1:n parallel synchronization mode which is suitable for railway operations and can cut down the number of cable channels and voice lines. Besides, the extensions are connected to the central dispatch in parallel, which allows the entire system to function normally even in the event of a breakdown in one of the stations.

The equipment has already been evaluated by the automation departments, and will begin to serve Beijing's subway system not long from now.

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DJS24 USED FOR WEATHER FORECASTING

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 14, 20 Jul 81 p 8

[Article by Pan Liangyuan [3382 5328 0337] of Yancheng Regional Planning Commission: "Preliminary Results Achieved in Computerized Weather Forecasting in Our Region"]

[Text] Weather changes are the combined results of many different kinds of factors. Some of the factors can be directly measured with meteorological instruments, such as air pressure, temperature, humidity, wind direction, wind speed, etc.; some factors have to be obtained through complex computation, e.g., the magnitude of atmospheric convergence, divergence and ascending speed, as well as the rotational motion of the atmosphere. These physical quantities are used to describe the motion of the atmosphere and are important objective bases for analyzing the weather. In the past, the improvement of forecasting accuracy had been affected to a certain extent by the limitations of computing tools which could not be used at all for any kind of application.

In coordination with Yancheng Prefecture Meteorological Observatory, the Computer Center of Yancheng Prefecture tried to improve the daily forecasting of the plum rain season in 1980; they computed the divergence, vorticity, vortex advection and vertical speed of three atmospheric layers at 850 millibars, 700 millibars and 500 millibars, covering approximately 2.9 million square kilometers at 2.6°N-40°N, 106°E-123°E. They used the finite-difference equation to describe the motions of the atmosphere. An experienced technician would take approximately 8 hours to manually compute the four items (i.e., divergence, vorticity, vortex advection and vertical speed) and 12 quantities of three layers with no guarantee as to the accuracy of the data. As the time factor is very essential tin weather forecasting, with manual computation, it is impossible to come up with the results in time for weather forecast announcements. In the summer of 1980, we used a DJS-24 computer to compute the day by day physical quantities in June-July 1975 and 1976, and the physical quantities of rainstorm days in June-July of 1976, 1977 and 1978. Besides, we also computed 54 sampling data obtained from 13 typhoons. It was on this basis that the preceding computation of four times and 12 quantities of three layers was performed daily at 0800 from 5 June to 21 July 1980. After entering the values at u, v points into the computer, it took only 11 minutes for the machine to print out the accurate results, thus improving the efficiency by more than 40 times. High-speed computation with computers not only provides the daily forecasting work with objective and reliable data,

but also serves meteorological broadcasts and supplies the meteorological observatories of our province and Shandong, Anhui and Zhejiang with analytical reports.

In 1980, eight rainstorms hit the Yancheng Prefecture during the plu rain season. With the help of the computer which produced reports on physical quantities data that clearly reflected the approaching rainstorms, six of the rainstorms were predicted at the accuracy rate of over 80 percent (the overall accuracy rate of the entire year was over 60 percent), thus reaching the national advanced level. On 24 June, the entire northern part of Yancheng Region experienced the worst rainstorm of the past decade (In Funing County, the total

rainfall reached 240 mm in 24 hours time); on the basis of computation results producing a timely and accurate forecast, which enabled concerned departments to take appropriate emergency measures that helped to prevent millions of yuan of damages and losses. For this, they received excellent commendations from concerned provincial departments.

In view of the excellent results of applying upper air physical quantities in weather forecasting, preparations have been made for providing even more accurate data for this year's plum rain season. Computers will play a greater role in weather forecasting.

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COMPUTERS USED IN CROP DISEASE FORECASTING IN ZHEJIANG

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 18, 20 Sep 81 p 1

[Article: "Zhejiang Province Achieves Preliminary Results in Using Computers for Long-Term Forecasting of Crop Diseases"]

[Text] In the past 1-2 years, the Zhejiang Computer Technology Institute has been working in coordination with Zhejiang Province Academy of Agricultural Science and Zhejiang Agricultural Department's Central Station for Tracking and Reporting Diseases and Pests in a joint project using the computer to conduct (long, medium and short term) forecasts on late rice crop disease in the province, and wheat/barley scab. Some encouraging results have been achieved. The success of long term forecasting, in particular, is of great use to agricultural production, as medium and short term forecasting can only be conducted during the middle or late growth period when the crop diseases are already beyond control and pesticides are no longer effective.

Last year, the mathematical statistical method was used in forecasting Zhenhai County's late rice crop diseases and insect pests. The computation results predicted serious calamity and the information was circulated in advance among concerned groups. It turned out that the prediction tallied with the actual disease conditions. At the end of February this year, they conducted the same computation on Jiaxing Prefecture's major and minor diseases; the results predicted light disease occurrence, which also tallied with actual conditions. Based on the long, medium and short term forecasting computation system, the Agricultural Science Institute of Jiaxing Prefecture worked in coordination with concerned crop protection departments and changed the old practice of extensively spraying "safety pesticides" by limiting the spraying area to only 220,000 mu of the entire region's 1 million odd mu, thus reducing the spray areas by 780,000 mu and cutting down the pesticide cost by over 470,000 yuan. The computer has earned the reputation of being a "good consultant" for predicting crop diseases and insect pests.

In recent years, the Institute and the Crop Protection Institute under Zhejiang Academy of Agricultural Science have expanded their late rice blast forecasting operations to 5 major prefectures and 18 counties. The computer has processed 170 years of accumulated historical information and 1.2 million data. Five comprehensive forecasting stations have been set up. The

Provincial Agriculture Department uses the computer's computation results as basis for its reports; in collaboration with the province's central station for tracking and reporting crop diseases and insect pests, it is planning to expand the wheat/barley scab disease forecasting operations to 32 counties throughout the entire province, thus allowing the computer to play a greater role in forecasting crop diseases and insect pests, open up a new path for our country's battle against crop diseases and insect pests, thereby insuring bumper harvests all year round.

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COMPUTER USE IN MEDICINE EXPANDING

Chief Applications

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 3, 14 Feb 81 p 8

[Article by Li Li [2621 0500]: "Computers in Medicine"]

[Text] As computer technology develops, more and more computers are being used for surveying medical data, automatic diagnosis, and mathematical stimulation of the human body. There are medium frame machines and minicomputers designed for both specialized and general purpose digital computing, as well as microprocessors and microcomputers. Medical computers are also known as fixed program computers as their programs are fixed and the machines can be directly used for processing without need for further programming. Computers are generally good at calculating averages, correlation functions, and fast Fourier transformation (FFT); other capabilities include: all kinds of statistical histograms, including histograms of the densities, spacings, latent periods, peak values and amplitudes of time/nontime oriented serial/nonserial pulses. Special computers are characterized by such features as easy to operate, no programming needed, high-speed operation, and ability to produce processed data immediately, which are difficult tasks for general-use machines.

Digital computers are mostly used for automatic diagnosis, developing treatment programs, and computing networks for storage of medical records and treatment data.

Microprocessors are mostly used in portable monitoring units, e.g., automatic controls for artificial arms, portable sphygmomanometers, automatic devices for measuring electrocardiograms (ECG) and cardiac rates, electronic ears, electronic eyes, etc.

Following are the chief applications of medical computers:

1. Processing of bioelectrical data and physiological information.

Electrocardiograms play a vital role in the diagnosis of heart diseases. To diagnose different kinds of heart diseases, electrocardiograms are put through pattern recognition, various discriminant functions are analyzed, Bayes formulas are established, and electrocardiograms are automatically classified.

The digital filtering of ECG can improve the signal-to-noise ratio, condense data, save computer storage space, and accelerate operation speed. With a microcomputer, KL conversion can compress data by 12-fold.

ECG digital communication is used for transmitting ECG data of patients from remote areas or small hospitals to computer centers for data processing and instantaneous diagnosis. Portable heart monitoring devices with microprocessors can record abnormal ECG changes and store the data in cassette tapes.

Body surface His bundle electrograms and the ECG of embryos are often drowned out by noises. To obtain the required data, computers are used for computing average values of correlation functions.

The analysis of alpha-rhythms in electroencephalograms (EEG) and the computation of self-correlation functions are useful for diagnosing brain tumors. When oxygen shortage occurs in the human body, EEG variations are much more acute than ECG. Thus, it is more useful to study EEG spectrum. The use of fast Fourier transformation (FFT) can instantaneously produce the required frequency spectrum graphs. Now we already have FFT microcomputer products.

The sudden changes in cerebral electric potential caused by stimulation from sound, light or electric signals are known as induced potential, the magnitude of which amounts to only several microvolts. As there is often noise interference, the measurement of cerebral induced potential also needs computers for averaging.

With the help of computer processing of electrocochlograms (?), it is possible to perform hearing measurement objectively, thus providing otologists with valuable clinical data. Electronic cochlea devices composed of integrated circuits can help deaf patients restore their hearing sense.

The processing of electroretinograms and ophthalmodonesograms (?) are useful for diagnosing eye diseases. Electronic eyes composed of IC circuits can help patients see light again.

Computer analysis of electrohepatograms and electrogastrograms is also very valuable for studying changes in livers and stomachs.

The Fourier analysis of electromyograms (EMG) can help determine the electrical responses of muscles under such conditions as motion, injury and nerve conduction. Artificial arms controlled by microprocessors have brought hope to patients with severed limbs.

The computer processing of blood pressure, respiration, blood circulation, heart sounds, body temperature, pulses, and other life indicators is all very important for the precise diagnosis of diseases.

The measurement of human physiological parameters under special environmental conditions often requires high-speed processing of multiple parameters which can only be performed by computers. For example, to compute the physiological parameters of spacemen, airplane pilots, divers and athletes, digital

communication is used for converting the physiological parameters into pulse codes and transmitting the data through carrier waves to the receiving end for computer processing.

2. Automatic diagnosis and clinical information database

To aid doctors of both Chinese traditional medicine and Western medical practices in diagnosis and treatment of patients, computers can simulate the records of patients treated by eminent doctors, and produce diagnostic reports of certain diseases as well as recommendations for medical treatment.

With computers, it is possible to set up databases to hold such information as medical history of clinical patients, physical checkup records and laboratory test reports; such databases are helpful for data retrieval, statistical computation, group consultation, and education. Centralized monitoring units in hospital wards enable processing of data on abnormal changes at all times.

3. Image processing

By using CT scanners, it is possible to scan portions of the human body with x-rays, conduct detection through highly sensitive detectors, process the information with computers, and display the images of various sections for diagnosis. This method enables early diagnosis of diseases with considerable degree of precision, thus greatly increasing cure rates. Computers are also used for automatic cell distinguishing; cells are put through a scanning microspectrophotometer which generates a group of digitized images reflecting the light transmittance or absorptance of various portions of cells; the information is then fed into the computer for turning out statistical histograms that can be used for identifying cancer cells.

Computers can generate stereoscopic pairs based on parallax. In the study of binocular vision, it is very useful to perform fast Fourier transformation of the frequency distribution of stereoscopic pairs in space.

4. Mathematic simulation of human body organs

To simulate human body organs with computers, it is imperative to build all kinds of mathematical models, e.g., mathematical models of neurons and nerve networks, mathematical models of respiratory gas-exchange process, mathematical models of the coding, processing and transmission of messages in the sensory system, as well as mathematical models of engineering psychology, neuropathological psychology, child psychology, etc.

The computer simulation of human organs is very useful. For example, through computer simulation of spinal injuries and pathological changes, and the building of human spinal mathematical models, it is possible to study spinal responses to all kinds of external forces. Another example: Vibrations, shocks or weightlessness often cause harm to human muscles or eyesight; the cardiac-vascular system, in particular, is most susceptible to environmental force changes. With computer simulation, it is possible to predict the impact of abnormal acceleration or weightlessness on the cardiac-vascular system.

At present, linear mathematical models are used for describing the majority of life phenomena; there are a lot of problems to be solved in nonlinear model description. As computers develop, man will gradually understand the law of life.

Further Details

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 4, 28 Feb 81 p 8

[Article: "News Briefs on Computer Applications in China's Medical Field"]

[Text] According to reports from the Research Society on Computerized medical Diagnosis and Treatment Systems, in recent years, many places across the country have been energetically developing computer programs based on the experiences of eminent doctors.

•The Hospital of Chinese Traditional Medicine in Heilongjiang Province plans to develop: (1) software based on Professor Gao Zhongshan's [7559 0112 1472] experiences in diagnosis and treatment; (2) software based on Professor Ma Ji's [7456 7535] experiences in diagnosis and treatment; (3) software based on Professor Han Bailing's [7281 4102 7227] experiences in diagnosing menstruation. By the end of 1980, they had compiled tables of medicines and symptoms.

•Zhejiang Medical University and Zhejiang Hospital of Chinese Traditional Medicine are coordinating their efforts in developing a program based on Pan Denglian's [3140 3397 3425] treatment of hepatitis. Based on previous case histories, Zhejiang's Medical University and the Surgical Unit of Zhejiang Hospital No 2 have jointly developed programs to identify and diagnose acute appendicitis and breast tumors. In late 1980, they also developed programs for diagnosing goiter and acute brain injuries.

•Kaifeng People's Hospital No 3 and Kaifeng Hospital of Traditional Medicine jointly developed programs for diagnosing and treating purpura due to loss of blood platelet based on the experiences of the eminent doctor of Chinese traditional medicine Zhang Nanzhi [1728 2809 3112].

•Heilongjiang Province's Zuguo [Motherland] Medical Research Center and Harbin Industrial University jointly developed a cancer treatment program based on the experiences of Zhang Qi [1728 3825], deputy director of the research center.

•Shanghai College of Chinese traditional Medicine is currently putting together a computer program for treating "dizziness" based on the experiences of Professor Jin Shoushan [6855 1108 1472], vice president of the college, and will try to complete the project in the first half of 1981. Their next project is to develop diagnostic and treatment programs based on the experiences of Professors Zhang Bousou [1728 0130 0652] and Xu Zhongchun [1776 0112 2625].

•The Academy of Chinese Traditional Medicine under the Ministry of Public Health, Beijing Hospital of Chinese Traditional Medicine and Xiehe [Union] Hospital have jointly developed (1) programs for diagnosing and treating

dysmenorrhoera based on the experiences of the eminent doctor Qian Boxuan [6929 0130 3551]; (2) program for treating diabetes based on the experiences of Zhu Shenyu [4376 3928 5280], an old doctor of Chinese traditional medicine.

•Late last year, Harbin City Hospital of Chinese Traditional Medicine developed a whole set of programs for treating pyelonephritis.

•Keifeng Hospital No 3 and Kaifeng Computer Institute jointly developed programs for diagnosing and treating coronary heart diseases based on Chinese traditional and Western medical practices, and programs for diagnosing coronary heart diseases based on Western medicine.

•Huabei Computing Technology Research Institute used a Chinese-made 183 machine for debugging two diagnostic programs developed by the Radiology Department of a general hospital: one is for identifying globular focus in the lungs, and the other is for diagnosing and identifying benign and malignant gastric ulcers.

•Shanghai City's Clinic of Chinese Traditional Medicine and Dongchang Hospital are working together on computer-aided diagnosis and treatment based on overall analysis of illness and patient's conditions in Chinese traditional medicine. They also worked on real-time processing and data processing of medical information. The machine used for these projects is a DJS051B microcomputer.

•Shanghai Hospital No 2 is developing a program for diagnosing and treating acute eye diseases based on the experiences of Lu Nanshan [7120 0589 1472], an old doctor of Chinese traditional medicine.

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CANCER DIAGNOSIS SOFTWARE PACKAGE PRODUCED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 22, 20 Nov 81 p 1

[Article: "Preliminary Results of Cancer Diagnosis Software Package"]

[Text] The incidence rate of cancer has increased in recent years. For the early diagnosis of cancer, Changzhou Radio Plant No 2 and concerned hospitals in Shanghai and Changzhou cities have jointly developed a special computerized metrological diagnosis software package for diagnosing stomach cancer, leukemia and lung cancer. The statistical approach is the principle for the development of the software. A table for computer diagnostic information was compiled from the clinical results and case summaries by experienced cancer specialists. This table is composed of symptoms and signs, which in turn can be used to differentiate cancer cases from noncancer cases. Adjustments were subsequently made by way of verification through large quantities of test and statistical data. Finally, the Bayes theorem approach, i.e., conditional probability extension, as well as fuzzy-region approximation and medical judgment were employed to determine the quantized values of various symptoms and signs, and all the information was then put through comprehensive computation and analysis, thus producing a critical limit index values for positive diagnosis of various cancers. The software program has the self-learning ability of automatically accumulating information based on diagnostic procedures and medical history. Results from preliminary tests in Shanghai and Changzhou indicate that the software can attain an accuracy of 85 percent in the diagnosis of stomach cancer and 97 percent for leukemia.

There is no doubt that the computerized system is far more convenient than other available methods for the diagnosis of cancer. It is an inexpensive means that can be extensively used in general surveys of cancer incidence in rural areas, factories, mines and other enterprises, as well as offices.

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COMPUTERS USED TO PRODUCE BIORHYTHMIC GRAPHS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 22, 20 Nov 81 p 8

[Article: "Biorhythm Measured by Computers"]

[Text] Scientists believe that there are three separate cycles in terms of which a person's physical, emotional and intellectual energy levels rise and fall beginning on the day of birth. When a person is at the climax of physical cycle, he is full of vigor; at the peak of emotional cycle, he is cheerful and optimistic; at the top of intellectual cycle, he has quick response and good memory. Conversely, when a person is at low ebb, his physical strength is weakened; he is easily tired, feels depressed and restless, has difficulty in concentrating his thoughts, and his work performance is correspondingly downgraded.

In coordination with Hangzhou Hospital No 1, the Computer Institute of Zhejiang Provincial Scientific and Technological Commission used its computer facilities to calculate the daily pattern of physical, emotional and intellectual variations, and came up with an equation for plotting biorhythmic graphs based on the Chinese ancient theory of Jingluo [main and collateral channels]. They developed a program in the BCY language on a TQ-16 computer. The program can rapidly plot biorhythmic graphs for a large group of people at different points of time. They wrote a similar program in MBASIC on a Cromemco A machine. The institute has already begun to use the computer to analyze the biorhythmic graphs of drivers in Hangzhou City's Traffic Bureau, and it has been discovered that in car accidents, the driver is usually in the critical state of extremely unstable physical and emotional conditions, and at the lowest point of intellectual cycle. The accuracy is amazing. The biorhythmic forecasting method is very useful for reducing traffic accidents. They also conducted analytical study of 100 patient cases in Hangzhou City Hospital No 1. The results indicated that 80 percent of the patients had contracted illness at the time when physiological conditions were either at a low ebb or unstable. During this particular phase, owing to the very poor emotional state, the organic immunity was greatly weakened, thus making the patients vulnerable to diseases. There were also instances of surgical complications arising at the time when the patients were in low ebb or unstable condition. All these pose an extremely important problem to the doctors, i.e., with the exception of emergency cases, surgical operations should be performed when the patients are at the peak of biorhythmic cycle.

Comrade Dai Dingkai [2071 1353 0418] of the Shanghai Semiconductor Research Institute developed a BASIC program which can print out biorhythmic graphs based on 23-day physical cycles, 28-day emotional cycles, 33-day intellectual cycles (see program listing). In the program, statements 10-47 constitute the dialog portion, i.e., the gathering of vital information through interactive question-and-answer session between the user and the computer. Statements 50-230 compute the total number of days from the date of birth up to the initial point of the print routine. Statements 235-970 are printing and plotting instructions.

Program Listing:

```
LIST
 10 PRINT 'WHEN WERE YOU BORN?'
 20 INPUT Y1,M1,D1
 25 PRINT
 30 PRINT 'WHAT DATE IS TODAY?'
 40 INPUT Y2,M2,D2
 42 PRINT
 45 PRINT 'HOW MANY DAYS DO YOU WANT TO PRINT?'
 46 INPUT P
 47 PRINT
 50 LET T=(Y2-Y1)365
 60 IF Y2-Y1%4 GO TO 80
 70 LET T=T+INT((Y2-Y1)/4)
 80 DIM A(13)
 90 LET A (0)=0
100 FOR N=1 to 12
110   READ A(N)
120   DATA 31,28,31,30,31,30,31,31,30,31,30,31
125 NEXT N
130 LET S=0
135 IF M2=M1 GO TO 230
137 IF M2%M1 GO TO 190
140 FOR I=M1 to (M2-I)
150   LET S=S+A(I)
160 NEXT I
170 LET T=T+S
180 GO TO 230
190 FOR I=M2 to (M1-I)
200   LET S=S+A(I)
210 NEXT I
220 LET T=T+S
230 LET T=T+D2-D1
235 PRINT 'THE TOTAL DAYS AFTER YOU WERE BORN: ';T
360 PRINT
370 PRINT
380 PRINT
390 PRINT TAB (10); '-1';
400 PRINT TAB (30);'0';
410 PRINT TAB (50);'1';
```

```
420 PRINT
450 FOR X=5 TO 55
460  PRINT TAB(X); '-';
470 NEXT X
480 PRINT
490 FOR X=1 TO P
500   PRINT TAB(2);M2;'.';D2;
510   LET H=T
520   LET H=INT(SIN(23,14159H/23)20+30)
530   LET M=T
540   LET M=INT(SIN(23,14159M/28)20+30)
550   LET I=T
560   LET I=INT(SIN(23,14159I/33)20+30)
570   DIM B(4)
580   LET B(1)=H
590   LET B(2)=M
600   LET B(3)=I
610   LET B(4)=30
620   FOR K=1 TO 4
630     FOR L=K TO 4
640       IF B(K)%B(L) GO TO 680
650       LET Q=B(K)
660       LET B(K)=B(L)
670       LET B(K)=Q
680     NEXT L
690     IF B(K)=H GO TO 730
700     IF B(K)=M GO TO 750
710     IF B(K)=I GO TO 770
720     IF B(K)=30 GO TO 790
730     PRINT TAB(H);'H';
740     GO TO 800
750     PRINT TAB(M);'M';
760     GO TO 800
770     PRINT TAB(I);'I';
780     GO TO 800
790     PRINT TAB (30);'.';
800   NEXT K
805   PRINT
810   LET G=A(M2)
820   LET D2=D2+1
830   IF D2>Q GO TO 860
840   LET T=T+1
850   GO TO 920
860   LET D2=1
870   LET T=T+1
880   LET M2=M2+1
885   IF M2>12 GO TO 910
890   GO TO 920
910   LET M2=1
920 NEXT X
930 PRINT TAB(2);'NOTE;H-HEALTH'
```

```
940 PRINT TAB(8);'M-MANNER'
950 PRINT TAB(8);'I-INTELLIGENCE'
960 PRINT
970 END
```

Note: HEALTH - Physical cycle;
MANNER - Emotional cycle;
INTELLIGENCE - Intellectual cycle

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COMPUTER USE IN ENVIRONMENTAL SCIENCE

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 Sep 81 p 8

[Article by Yu Tong [5713 4827]: "Environmental Science and Computers"]

[Text] 1. Ways of Gathering Environmental Data

To gather environmental data, many monitoring network nodes have been set up in various parts of the world. In automatic monitoring, some places employ independent monitoring stations controlled by microcomputers, some places use semiautomatic offline systems tied into networks or fully automatic online systems. There are local as well as nationwide systems. The river water monitoring system in Ohio, the United States, is an offline, nonrealtime data gathering system configured with IBM1130 and peripherals, such as magnetic tape drive, disk storage, etc. PH values, oxido-reduction potentials, chloride ion concentrations, and other parameters are measured by 17 monitoring posts and transmitted to the central station via telephone lines; the information is printed and punched into cards for the computer to analyze and process. The air pollution automatic monitoring system in Frankfurt, West Germany, is configured with a supervisor computer which can automatically and continuously check and adjust testing instruments. Routine data outputs provide half-hourly mean values or daily mean values of all the parameters, as well as dynamic values of certain parameters. The parameters are also punched into paper tapes and sent to a large-frame computer which evaluates the data and produces reports on frequency distribution and excessive concentrations.

Telemetering and remote sensing techniques which are closely related to computer technology are now used in such areas as monitoring resources, water, land, vegetation, oil pollution, heat pollution, etc. for example, the United States uses a telemetering satellite for monitoring cities and energy utilization patterns, and an IBM370/158 system is used for analysis and computation.

There are many kinds of environmental data which are obtained through sampling and precise lab analysis. The use of intelligent instruments armed with microprocessors simplifies operation, reduces turnover time, and guarantees degree of precision. To achieve complete lab automation, a central computer is used for supervising the instrument operations and data gathering/processing of the entire laboratory, e.g., in the United States, the research on Delta Park (?) air monitoring network labs has further improved lab automation.

2. Prediction and Evaluation

To better predict pollution trends, it is necessary to establish pollutant diffusion models, e.g., the Air Quality Diffusion Model (AQDM) which is used for computing the average long-period concentration of surface pollutants is now employed for describing the characteristics of SO_x and suspended particulate matter. It requires such parameters as pollution sources data, meteorological data, as well as actual measurements of SO_x and particulate matter concentrations, which are input into the computer. A typical AQDM model program requires 275K of main memory, and the computation requires more than 10 hours of operational time on the IBM360/50 system. Without large capacity and high-speed computers or the required software, it is difficult to produce mathematical models of practical value.

The environmental quality index is the condensation of large volumes of primary data; it provides the basis for conducting overall evaluation of environmental quality. In Osaka's environmental quality evaluation, five pollution factors are chosen as evaluation criteria. To determine the weights, 14 variables are input into a FACOM 230-60 computer which produces comprehensive evaluation indexes.

Adequate environmental information is extremely important for making policies regarding environmental problems as well as conducting environmental research. Many countries and regions have set up environmental databases; the United Nations Environmental Planning Program also has an environmental information source retrieval system. Without computer technology, it is almost impossible to instantaneously sort, index or update such enormous volumes of data (e.g., in the United States, the National Air Data Bank had accumulated 500 million characters of data in magnetic tapes by the early 1970's), and provide users with information according to required formats. The Water Quality Control Information System (STORET) of the United States Environmental Protection Program uses an online large-capacity random access storage system for storing data from more than 10,000 different locations, covering water quality, water quality criteria, urban waste water, water areas, sea coasts, geographical locations, etc. Users can use their terminals to retrieve information from the system control computer via local or long-distance telephone lines. The database can output the water quality data in 10 different ways, such as mean values, maximum/minimum values, variance, etc. It can also plot water quality charts according to the user's format requirements.

There are quite a few successful computer applications in environmental pollution control. For example, the St. Paul Health Region Water Drainage Control System (MSSD) in Minneapolis can draw the sewage water into a purification plant, and subsequently into the Mississippi River. When the conduits are overflowed by heavy rain, the sluice gates are opened to allow the water flow directly into the river. The system employs a PDP-9 computer for polling information from various monitoring points along the river and underground conduits; the data is gathered and combined with the rainfall for analysis by the computer which formulates water routes enabling sewage water from the heaviest polluted areas to flow into the purification plants for treatment, thus minimizing pollution of the river.

Quite a few mathematical models of environmental problems have been developed and used for simulating heat growth, BOD, sewage water treatment, insect pest control, pollution forecasts, etc. For instance, microchemical models developed for studying the end result of chemical compounds dispersed in the atmosphere can be used for simulating large numbers of chemical reactions that are correlated to reaction rates; they can also be used for simulating any part of the entire process from the time when the reaction begins to the time of equilibrium. The prediction and evaluation of the environmental quality of large-scale engineering projects is of vital importance to controlling environmental quality; some commonly used models are: Reobord's (?) matrix method, overlapping method, Barter's (?) environmental influence evaluation system, and environmental pollution analytical model, etc.

Implementation program models, environmental monitoring network budgetary estimate models, environmental control impact on economy models, etc. are all used in environmental control. FORTRAN-IV and COBOL-F implementation program models can be used for evaluation air pollution control strategies. For example, based on the current status and projected growth of local drainage sources, various control plans are evaluated against predetermined air quality criteria, and the lowest cost plan is chosen among the various feasible plans. This type of program requires 10-15 hours of operation on an IBM360/40 system.

3. Conclusion

Some people contend that computer simulation technology forms one of the bases for developing environmental science in an interdisciplinary science. This argument is quite reasonable.

Everyone wants to live in a good environment, and we are all continuously striving to improve our environment. As a powerful tool, computers are bound to play a greater role.

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NEW PUBLICATIONS ON COMPUTERS PUBLISHED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 23, 20 Oct 81 p 8

[Text] Microcomputer Basic Technical Manual Published

The Science Publishing House recently translated and published a manual of basic microcomputer technology written by a well-known Japanese specialist on microelectronics technology, Yojiro Yokoi. The manual consists of 10 chapters which are divided into 2 major parts; the first 6 chapters deal with basic concepts related to microcomputers, the basic working principles of microcomputers, basic technical information on system storage and peripherals, and basic concepts involved in microcomputer software research. The last four chapters are devoted to various topics on Motorola's 2d generation microprocessor M6800, i.e., basic working principles of its hardware, software characteristics of M6800, all kinds of exercises for programming the M6800 microprocessor, and, finally, commonly used basic programs for the M6800.

Manual of Typical DJS-131 Application Examples

The DJS-131 is a 16-bit minicomputer with comparatively good capabilities, complete peripheral support, and relatively complete and rich library of software. It can be configured into real time system, timesharing system and dual-processor system; it is suitable for industrial controlling, data processing, and scientific computation.

The 131 machine is widely used throughout the whole country. With this machine, the following user organizations have achieved excellent economic and technical results: Shanghai Telegraph Bureau, Shanghai Sparetime Industrial College, Shanghai Semiconductor Research Institute, Shanghai Radio Plant Nos 7 and 14, Huadong [East China] Electric Power Administration Bureau,and Zhengzhou Electric Power Supply Bureau. To facilitate the exchanging of experiences and promote the popularization of the use of this model, the Shanghai Computer Plant, with the full support of users, has compiled a book entitled "System Capability and Application of DJS-131 Computer." The book is divided into three major parts: (1) General Introduction; (2) DJS-131 System Capabilities; (3) Typical Application Examples. The book is expected to be published in October.

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- END -

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No. 180

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APPLIED SCIENCES

INVENTIONS APPROVED BY SCIENTIFIC COMMISSION

OW231004 Beijing XINHUA Domestic Service in Chinese 1136 GMT 21 Oct 82

[Summary] Beijing, 21 Oct (XINHUA)--Recently the inventions evaluation committee of the State Scientific and Technological Commission has approved a number of inventions, including the following:

Technique for growing large acreage of rubber trees between 18 and 24 degrees north latitude;

3L- and RJ-series emulsified explosive;

WH 122 artillery shell;

New-type anti-aircraft machine gun;

Molding technique for silicon rubber larynx for laryngocarcinoma patients after surgery;

Acid-resistant steel and welding rod which can stand high temperature and sulfuric acid of moderate concentration;

Nickel-base high-temperature alloy;

No 710 steel for making thin-wall pipes;

Device for simulated detonation of mortars;

Model LD-3 electric detonator;

Powerful rotationary and contrarotationary tracking device [qiang li xuan ya fan xuan gen zong zhuang zhi 1730 0500 2467 1090 0646 2467 6418 9338 5944 4999];

Quick-loading cartridge [kuai zhuang dan gu 1816 5944 1734 7849];

Method of controlling nematode disease for tussah silkworms;

New process for growing large fine-quality single crystals of alpha lithium iodate;

Production process for nucleotide for medical use by using penicillium mycelium;

Anti-oxidation lead welder;

Allo-1, allo-2 and allo-3 catalysts for synthesis of ammonia;

New F-hpam water sealant for oil wells;

GY-340 anaerobic room-temperature quick-hardening adhesive and the related GC-1 catalyst; and

Experiment for simulated air drop of dirty bomb detonators [ang dang yin xin kong tou mo ni shi yan 7542 1734 1714 0207 4500 2121 2875 2362 6107 7526].

CSO: 4008/11

BRIEFS

ZHEJIANG IMPORTED TECHNOLOGY--In the past 8 months and more, Zhejiang Province has imported 37 technologies, using foreign capital and loans totaling U.S.$18 million, for technical transformation in 31 small and medium-sized enterprises. These technologies, for use in the plastics industry, tannery, silk printing and dyeing, garment processing, electronics, meters industry and furniture making, are advanced from the 1970's level. [Hangzhou Zhejiang Provincial Service in Mandarin 1030 GMT 13 Oct 82 OW]

TEXTILE SCIENCE, TECHNOLOGY--The national conference on scientific and technological work in the textile industry was held in Jiangsu's Nantong Municipality from 13 to 19 October, attended by more than 100 leading comrades of textile industrial departments and scientists and technicians from 28 provinces, municipalities and autonomous regions. The meeting summarized the experience gained in scientific and technological work in China's textile industry in the past 2 years and studied and formulated plans for 1983. The participants felt that, in the guiding thought for developing the textile industry, the stress should be switched from speed, output and production capacity to variety, quality, economic results and technical transformation. He Zhengzhang, vice minister of textile industry, attended and addressed the meeting. [Nanjing Jiangsu Provincial Service in Mandarin 1100 GMT 19 Oct 82 OW]

PRC, EEC PLASTICS SEMINAR--Beijing, 22 Oct (XINHUA)--A symposium on exchange of technology in plastics processing organized by the China Council for the Promotion of International Trade and the European Economic Community (EEC) was held in Beijing between October 18 and 22. A nine-member delegation from the EEC and 150 Chinese experts and technicians from light industrial and machinery departments discussed processing techniques in the plastics industry. This is the first time the EEC has sent a technical delegation to China. This visit will enhance technical interchange and economic and trade relations between China and the community, according to sources at the symposium. The EEC delegation arrived in Beijing on October 15. They will also visit Tianjin and discuss technological exchange there. [Text] [OW221303 Beijing XINHUA in Englis. 1240 GMT 22 Oct 82]

BRIDGE ENGINEERING BOOK--Beijing, 17 Oct (XINHUA)--Recently the science popularization publishing house has published volume 1 of the "Selected Science Popularization Works by Mao Yisheng." Mao Yisheng, now 87, is a celebrated Chinese expert in bridge construction. This book predominantly contains articles which have been published since liberation. In these articles, the writer explains the basic of bridge construction in an interesting and yet easy-to-understand way and points out the role of Chinese bridges in world architectural history. [Beijing XINHUA Domestic Service in Chinese 0012 GMT 17 Oct 82 OW]

GROUND SURVEYING SYSTEM--Beijing, 21 Sep (XINHUA)--For the first time in the world, a full-scale balance [zheng ti ping cha 2419 7555 1627 1567] for a ground surveying control system has been completed in China. Geographical coordinates of over 50,000 surveying points have been precisely calculated and a new, independent and highly precise system of ground coordinates has been established. The precision of surveying and drawing work is of great importance to the development of national economy and national defense projects, as well as science and technology. With the development of economic construction and national defense construction, the demand for precision in geographical coordinates has become greater and greater. In this connection, full-scale balancing is conducted so that the influence caused by errors in surveying work can be reduced to the minimum. Since 1978, tens of thousands of scientific personnel from the State Bureau of surveying and cartography, the surveying and drawing department under the PLA general staff department and other departments concerned have been engaged in this arduous work. [Beijing XINHUA Domestic Service in Chinese 0251 GMT 21 Sep 82 OW]

GEOLOGICAL SYMPOSIUM--Nanjing, 25 Oct (XINHUA)--More than 150 Chinese and foreign geologists will begin a two-week discussion in Nanjing, capital of Jiangsu Province, of questions relating to geology of granites--a branch of science that is of great importance to the exploitation of mineral resources and the study of the formation of the continental crust. The symposium will be sponsored by Nanjing University, one of China's major institutions of higher learning, whose scientists have surveyed and studied granites over areas totaling more than 200,000 square kilometers in south China. Good results were achieved when granite geological theories developed by Nanjing University scientists were used to guide the prospecting for minerals. For this, said Professor Xu Keqin, a prominent Chinese geologist and member of the Chinese Academy of Sciences, the university was given a national natural science award, second grade. This is the first time that a Chinese university will sponsor an international science symposium. Chappell Bruce of Australia, Didier Jean of France, Augustithis Stylianos-Sarvas of Greece and other internationally prestigious geologists will attend the symposium and deliver academic papers. [Text] [OW251354 Beijing XINHUA in English 1256 GMT 25 Oct 82]

GEOGRAVITY RESEARCH--Wuha, 13 Oct (XINHUA)--China has established a complete system for absolute and relative geogravity monitoring, taking it well along the way toward advanced world levels, according to scientists who participated in a recent geophysics symposium held here. Among other things, the system will enable scientists to revise the orbits of satellites and booster rockets and survey China's oil and metal mineral resources. It is also expected to be of use in metallurgy, surveying, marine science, earthquake prediction and space science. A number of studies on solitons and their application in China are quite advanced, according to papers read at the symposium. China has made significant progress in the study of both geogravity and solitons, in the manufacture of geogravity instruments and meters and geogravity observation technology. Several domestically manufactured meters have attained fairly high technological levels, including a distance-measuring constant-temperature gravity meter, a marine gravity meter, a tidal gravity meter and a precision absolute gravity meter. [Beijing XINHUA in English 0703 GMT 13 Oct 82 OW]

CSO: 4010/10

USE OF RADIOACTIVE NUCLIDES TO SHOW LYMPH SYSTEM NOTED

Beijing JIANKANG BAO in Chinese 15 Aug 82 p 3

[Article by Zhang Zongmei [1728 1350 5019]]

[Text] The lumph system is one of the important systems of the body, forming a nautral pathway for the spread of tumors. Therefore, it has an important function in the process of the development of tumors. At present, there are not many techniques of examining the lymph system outside of the body [extracorporeally]. Although x-ray lymphography has a relatively high resolution factor, it is only suitable for finding the anatomical position of lymphatic ducts when it is used on the body surface. Radiolymphography is a simple, safe, and harmless technique of examination for the understanding of the shape of the lymphatic ducts and their physiological and pathological changes, from outside the body. Xie'erman [transliteration] began in the fifties to inject the radioactive nuclide ^{193}Au gel into spaces of tissues to study the way of producing radiolymphography. Since then, some domestic and foreign scientists have devoted themselves to this research and obtained some definite achievements.

Through studies in recent years, using radiolymphography on the side of the chest bone of patients with breast cancer it is believed that the lymph nodes on the side of the chest bone may possibly be a more direct path of metastasis of breast cancer. Due to the fact that there is not yet a routine technique of examining the lymph node on the side of the chest bone, the radiolymphography is a simple and convenient technique, enabling the spread of tumor at that locality to be discerned relatively early. The technique has a definite clinical value for distinguishing the stage of breast cancer, selecting a treatment program, determining the area for radiotherapy, the effect of treatment, and the follow-up prognosis.

After a radioactive gel of a suitable physical property is injected in the space of tissues, the grains of the gel can infiltrate the lymphatic capillaries to flow into a part of the lymph node and to move with the lymph toward the heart, and in every step on the way it is picked up by the lymph nodes. Within a suitable period after it is injected, scanning or x-ray photography may proceed and the radiolymphogram may be obtained. The key to the quality of the lymphogram is the diameter of the grain of the display agent. It is generally believed that the grain size of 1-10 $m\mu$ is the most suitable. In [1976] Ege [transliteration] first reported the use of the isotope technetium antimony sulfide for

display of lymph node inside the breast. After satisfactory results were obtained with this technique, it has been gradually adopted at present as the best lymph x-ray photography agent in foreign countries.

The Isotope Laboratory of the Beijing Municipal Research Institute of Tumor Prevention and Control cooperated with the Beijing Research Institute of Atomic Energy to succeed in making the antimony sulfide gel and in 1980 the isotope technetium antimony sulfide gel was also successfully made. The grain size is suitable (4-12 mμ) and the labeling rate is above 95 percent. Animal experiments have proved that this product has a high degree of concentration in the lymph nodes and it has also been certified to be safe, germfree, and heat free. In October 1980, it was clinically tested in the examination of 168 patients. The lymphograms were clear and comparable with the small grain ^{193}Au gel. It can also be frequently repeated. The person being examined suffered no pain and there was not a single case of an unfavorable reaction.

Results of clinical tests indicate that the isotope technetium antimony sulfide gel, as the best nuclide lymphographic agent, has the following merits:

The isotope technetium labeled antimony sulfide prefabricated gel has small and even grains, with 76.1 percent having a diameter of 6-10 mμ, the most suitable size to be picked up by lymph nodes. The behavior of the antimony sulfide gel in the body is stable; therefore, the pick-up rate by the lymph system is high, the picture clear and beautiful.

The physical properties of the isotope technetium are relatively good to make it suitable for scanning and γ photography. The resolution factor is high, the physical half-life is short, and only a single-low energy γ ray is released. The radiation dosage of the lymph node is only 0.4 rad/m Ci, amounting to only 1/100 of that of ^{193}Au.

The method of preparation is simple and the product reaches the standard of isotope technetium autimony sulfide made in foreign countries.

In a word, the best nuclide lymphographic display agent--isotope technetium antimony sulfide has been successfully made in China to provide a favorable condition for the prevention and control of tumors. This is a welcome achievement of China's nuclear medicine.

6248
CSO: 4008/2

ADOPT SCIENTIFIC ATTITUDE IN PUBLICIZING SCIENTIFIC ACHIEVEMENTS

Beijing RENMIN RIBAO in Chinese 21 Sep 82 p 3

[Article by Wu Jieping [0702 7132 1627]]

[Text] The number of newspaper and magazine reports and articles about achievements in medical science have been increasing in recent years. They are welcomed by the masses and have exerted a positive influence in popularizing the scientific knowledge of medicine to mobilize the active participation of the masses in the work of prevention and control of diseases. It also should be pointed out that some newspaper articles do not have such an influence, however. On the contrary, they create wrong impressions and confusion.

I, as a medical professional, have often encountered sudden requests from patients and their families to stop the originally effective treatment and to apply a certain new drug or new method. The reason for a request of this kind is that they have read some related reports, which do not introduce the real condition but instead emphasize the results in a general manner. They do not talk about the area of application. Or, they may speak of items that are still in the process of research and investigation as operational techniques, or even regard something that has no scientific foundation whatsoever as the magic of all magics. For difficult to treat diseases such as malignant tumor, if the newspapers reports are not factual the result can be even more serious. After reading such reports, some patients refuse to accept the original treatment. They take old and young, at a tremdous expense and run to the doctor or hospital reported in the newspaper article. As a result, the patient's disease is aggravated by the exhaustion of running around while the hospital in the report also suffers from hardship. Similar conditions have also occurred when foreign newspapers report about medical achievements. For example, one newspaper published news of a foreign medical achievement, with the headline: "Wonderful Tidings for Disease Long Suspected To Be Incurable." The article stated that a foreign medical scientist had clarified the pathogenesis of Parkinson's disease which had long been regarded as incurable, and developed a new specially effective drug for it. In reality, this new drug is still in an experimental stage and has not been clinically applied. Three months or so later, that newspaper published another news item, saying that many readers all over the country had written to the newspaper, as well as to the foreign professor mentioned in the previous article. The professor asked the newspaper to tell the readers that "The new treatment technique is still in the experimental stage and it will be at least 5 more years before its clinical application." This is the sort of

condition created by reporting something without understanding the true condition and without considering the after effect of a newspaper report.

There was a period of time when I received many letters asking me to help change the sex of the writer. This was caused by a newspaper article concerning my treating patients of serious external genital abnormalities (the so-called male-female persons). The article did not state clearly that while some of these persons can determine their true sex by having the abnormality corrected, it is not true that a normal person can change his or her sex at random. Just about that time, another publication produced an excerpt of a translation of a foreign report, headlined as "Sex Reconstruction School in England." The paper in fact dealt with a specialty of treating male-female patients. This erroneous headline further intensified the misunderstanding of some readers. All the troubles of physicians who have to explain to their patients why a certain treatment technique is not suitable for them will never be known. These physicians are often never understood by patients and their families, and sometimes they are accused of being too conservative.

Many achievements in medical research are products of cooperative efforts, contributions of a collective body. If the newspaper report improperly emphasizes the function of one particular individual, the solidarity and cooperation of scientists and technicians will be dealt an unfavorable blow. The conflicts among some scientists or organizations are related to some less than true newspaper reporting. In such columns as "Personal Interviews" exaggerations must be avoided. Titles like the "founder of..." must not be hastily used before the truth is learned through serious investigation. In an article about my medical research work, a newspaper flashed the headline saying that I was the one who established the foundation or urosurgery in China. This claim is not in keeping with the facts. I did do some work in the development of urosurgery in New China, but specialists of urosurgery of our country's older generation had made accomplishments and several of them are still living. Their contribution in nurturing many specialists, including me, is very considerable. It was only after my request that that newspaper published a letter of mine [to correct the original error.]

Whenever a newspaper publishes articles of an informative and interesting nature, a scientific attitude must take precedence and the news must also be of some practical value. Some errors in the reports may be related to a deficiency in spiritual cultivation on the part of some scientists and technicians themselves, but some errors are in fact the doings of the reporters and editors. I believe science should be reported with a strict scientific attitude, emphasizing the truth. Opinions of special departments and related persons should be consulted and there should be full consideration of possible results of the publication. Medicine is an applied science. It is intimately related to everybody's health. When a reader reads about a method capable of helping him or her resolve the problem of his or her own disease it is only nautral that he or she should pursue it in every possible way; therefore, this type of report requires extra caution.

I hope I am able to arouse the attention of authors, reporters, editors, and readers to this problem.

The opinion of Comrade Wu Jieping is worthy of the attention of our editors, reporters, and some writers. Scientific accuracy is one of the basic requirements of science and technology reporting. Our people trust newspapers very much and reports of science and technology must be highly responsible to the people and a scientific and serious attitude must be adopted. This paper is willing to join other publications in a common effort to avoid errors in reporting science and technology. Once an error is discovered it will be corrected in a timely fashion. We hope for the support and counsel of the readers and the specialists of all fields.--the Editor--

6248
CSO: 4008/2

BRIEFS

MORPHINE DISCOVERY AWARD--Beijing, 31 Aug (XINHUA)--Two Chinese scientists have determined and isolated analgestic mechanism of morphine, winning a national science award, according to an official of the State Scientific and Technological Commission. Zou Gang and Zhang Changshao, researchers of the Shanghai Institute of Materia Medica of the Chinese Academy of Sciences, have found that the sphere of action of morphine is the grey matter around the third ventricles and adueduct of the brain. Through the action on the sphere, morphine indirectly acts on other parts of the central nervous system to ease pain. In recent years, Zou Gang and his associates have compared the analgesic mechanism of morphine to acupuncture analgesia demonstrating that acupuncture accelerates the release and synthesis of morphine peptides of the brain, thus playing an analgesic role. [Beijing XINHUA in English 1247 GMT 31 Aug 82 OW]

CSO: 4010/14

SCIENCE FUND FINANCES RESEARCH PROJECTS

OW161144 Beijing XINHUA in English 0722 GMT 16 Oct 82

[Text] Beijing, 16 Oct (XINHUA)--A committee of the science fund of the Chinese Academy of Sciences, meeting at a conference here yesterday, approved financing projects to draw up highly detailed charts on China's soil, vegetation, land resources, land utilization, land types, geomorphology and grasslands.

Committee sources said that each chart, drawn at a scale of 1 : 1,000,000, would involve participation of dozens of work units, as well as the efforts of well over a hundred scientists across the country.

"It is of great significance to the understanding of China's natural resources, their opening and the mapping of production plans," one source on the committee told XINHUA.

The conference of the science fund committee, which began on October 14, discussed research projects that call for an allocation of more than 100,000 yuan, along with a revision of operational procedures for the fund and its work for next year.

By the end of September the committee had received a total of 1,361 applications for the year 1982. The applicants are from 211 institutes, of which 106 operate under universities and colleges.

Beginning in May this year, the science divisions of the Chinese Academy of Sciences have organized scientists to discuss, appraise and judge the applications. To date, 419 projects have been approved, of which 114 involve physics and mathematics, 94 chemistry, 98 biology, 27 earth sciences and 86 technical sciences.

In assessing the applications, the science fund committee acts in a democratic way: those projects that are of scientific and practical significance, have clear academic ideas and feasible and rational technological plans and are expected to yield results in a comparatively short period of time win active assistance. Attention has been paid to supporting middle-aged and young scientists and scientists in the border regions to promote the development of science in the remote areas and the growth of scientific talents.

CSO: 4010/9

AUTHOR: GUO Juming [0948 1565 2494]
YUAN Faxiang [5913 4099 4382]
KANG Zhenxi [1660 2182 0823]

ORG: All of Xining Research Institute of Plateau Machines and Electricity

TITLE: "Power Recovery Tests of the Turbocharged Jiefang CA10B Model Trucks at Plateau Regions"

SOURCE: Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 8, 25 Aug 82 pp 2-7

ABSTRACT: The Jiefang CA10B trucks are the major transportation tool in the Qinghai-Xizang Plateau region. Due to the high altitude and low atmospheric pressure of the region, the power and the torque of the engine are reduced to cause the fuel consumption to increase. In 1980-81, the authors studied and experimented with the exhaust turbocharge technique and succeeded in obtaining a maximum power of 95 hp and a minimum oil consumption of 250 g/hp-hr to provide an effective means of reconstructing Jiefang trucks and other similar automobiles to improve their transport efficiency and to reduce fuel consumption. The supercharger used in the tests is the 3GJ-1 II, manufactured by Wuxi Motive Power Machine Plant. Technical and fuel consumption data of the truck before and after the modification are reported in some detail.

6168
CSO: 4009/20

AUTHOR: YUE Zhonglu [1971 6988 4389]

ORG: None

TITLE: "Brief News of Certification of the Prototype of the Moveable Belt Type Conveyer Series"

SOURCE: Beijing QIZHONG YUNSHU JIXIE [HOISTS AND CONVEYANCES] in Chinese No 8, 6 Aug 82 p 64

ABSTRACT: The Bureau of Heavy Mining Machinery of the Ministry of Machine Industry called a conference in Hangzhou on 21-24 May 82 for the certification of the DY series of moveable belt type conveyers. The Research Institute of Hoist and Conveyance Machinery has been responsible for designing the conveyer with the participation of Hangzhou Conveyance Equipment Plant, which also made the prototype. The conveyer belt is 500mm in width; the machine is 15 m in length, with a variable angle of inclination. Participants to the technical certification conference of this DY5015 conveyer included 47 delegates representing 27 organizations engaged in designing, scientific research, manufacture, and machinery utilization. The delegates believed that compared with conveyers of the old, this machine moves more easily, is capable of moving horizontally, consumes less energy to move up and down, has little noise, is stable, and moves reliably. All agreed that its major properties have met the requirements of the design and its parameters and properties have reached the domestic advanced level. The delegates suggested that related departments start official production of this new product.

6168
CSO: 4009/16

AUTHOR: TONG Linsu [4547 2651 1121]
QIU Mulan [8002 2606 5695]
XU Yixian [6079 0076 0341]

ORG: All of the Nanjing Institute of Technology

TITLE: "Theoretical Study of Rotationally Symmetrical Electron Emission Systems"

SOURCE: Nanjing NANJING GONGXUEYUAN [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 3, 1982 pp 164-180

TEXT OF ENGLISH ABSTRACT: The effects of space charge and thermal velocity are taken into account, and the Monte Carlo Method (MCM) is proposed to deal with the rotationally symmetrical electron emission systems in cathode ray tubes. This method can be advantageously used for computing electron emission systems with fully considered factors, especially the inherent discrete property of the electron to be considered; a direct view model; the simple program structure, and its high accuracy. It takes a rotationally symmetrical system as an example for discussing the main steps for computing electron emission systems by means of MCM, especially using random numbers to take samples from the initial electron energy distribution, and particularly discussing the direct cosine and azimuthal angle.

[Continuation of NANJING GONGXUEYUAN No 3, 1982 pp 163-180]

Finally, several practical computation examples are given. The planar diode is calculated by means of MCM and compared with the analytical solution. The relative error is 0.8 percent. In comparison with the experimental value of the experimental standard diode, the relative error is 8 percent. Calculations are further given for the cross-over gun and laminar flow gun, and their performances are compared from the viewpoint of current density and energy distribution. It indicates that in the case of unmodulation or modulation under which the laminarity of the electron beam has not deteriorated, the laminar flow gun seems to be better than the cross-over gun.

AUTHOR: ZHANG Mingde [1728 2494 1795]
WANG Zuming [3769 4371 2494]
YANG Xianglin [2799 4382 2651]

ORG: All of Nanjing Institute of Technology

TITLE: "Optimal Control of the Microwave Field Distribution at the Interaction Region of the Gyromonotron"

SOURCE: Nanjing NANJING GONGXUEYUAN [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 3, 1982 pp 181-193

TEXT OF ENGLISH ABSTRACT: In this paper, the requirements for the longitudinal distribution of the microwave field in order to optimize the efficiency of the gyromonotron are studied. Starting from the equation of relativistic particle dynamics, under the guidance of the optimum control theory, the state equations, conjugate equations and objective function and its gradient are derived in detail, which are necessary for optimizing the interaction process in the gyrotron. The computation program is compiled and the optimal longitudinal field distribution in the gyromonotron is computed.

9717
CSO: 4009/15

Identification of Molds

AUTHOR: LU Weiduo [6424 4850 1122]
ZHENG Guoyu [6774 0948 6877]
LIU Zili [0491 5261 0500]
WANG Yongsheng [3769 7167 3932]

ORG: LU, ZHENG of Department of Biology, Lanzhou University; LIU, WANG of Central Station, Northwest Meat, Eggs, and Food Biological Inspection Research

TITLE: "Isolation and Identification of Molds in Cold Storage of Lanzhou Prefecture"

SOURCE: Lanzhou LANZHOU DAXUE XUEBAO-ZIRAN KEXUE BAN [LANZHOU UNIVERSITY BULLETIN (Natural Sciences Edition)] in Chinese No 3, 28 Sep 82 pp 90-102

ABSTRACT: From the cold storage of Lanzhou, 32 strains of molds have been cultured, isolated, and identified. They belong to 2 orders, 4 families, and 7 genera, with Penicillium the dominant genus, having 18 strains, amounting to 56.25 percent of the total of 32 strains. The next numerous genus is Aspergillus, having 5 strains. Ever since the discovery of Aspergillus flavus toxin in turkeys in England in 1960, molds in foods have attracted attention in many countries. With the development of animal husbandry and cold storage industry in China, problems of mold contamina- of meat and eggs in cold storage have been discovered many times. The authors plan to start from isolation and identification to determine the types, the toxin, and the damage from molds to eventually proceed with studies on mold prevention and elimination. This paper is a preliminary report of the first part of the research project. This paper was received for publication in Apr 82.

6248
CSO: 4009/24

Measurement Device

AUTHOR: None

ORG: None

TITLE: "Small Thrust Movement-controlled Engine Thrust Measurement Device Approved Through Technical Certification"

SOURCE: Dalian DALIAN GONGXUEYUAN XUEBAO [JOURNAL OF DALIAN INSTITUTE OF TECHNOLOGY] in Chinese No 3, Sep 82 p 74

ABSTRACT: In 1977, a paper of B.C. Barber of England reported the use of complex electronic computation circuit and reverse transfer function lines to measure signal distortion and the signal after compensation to test the thrust of a large engine of a satellite in motion. The Piezoelectric Gauging Research Group of the Department of Machinery, of Dalian Institute of Technology proposed a piezoelectric type no displacement force measurement formula to obtain the dynamic thrust without any complicated circuits or any compensation. The device was twice successfully tested in Mar 81 and Apr 82 on the movement-controlled engine of the satellite Tianwen No 1. On 3-5 Jun, a certification conference was called; the 11 specialists and researchers representing agencies of Chinese Academy of Sciences and the Ministry of Space Navigation Industry attended. According to the opinion of the certification conference, the force measurement technical specifications of the device generally correspond with the level of the middle 70's in Europe, when they are compared with related foreign data.

6248
CSO: 4009/27

AUTHOR: LI Zhijiu [2621 1807 1432]

ORG: None

TITLE: "Portable Acidimeter Testing Instrument Successfully Made"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 5, 18 Sep 82 p 63

ABSTRACT: The SJY-1 portable acidimeter testing instrument, successfully made by the Nanning Municipal Measurement Management Center of Guangxi Province has, most recently, undergone technical certification. This instrument is designed for physical chemical measurement technicians to test the accuracy of an acidimeter on site when they are working either at a factory or in the countryside, even though the temperature and the voltage of the electric power source of the work site may fluctuate a great deal. At present, the instrument is being manufactured in small batches according to the needs of related organizations.

AUTHOR: None

ORG: Hot Work Division, Chinese Research Academy of Metrology

TITLE: "Explanation of Front-Cover Photo"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 5, 18 Sep 82 p 63

ABSTRACT: The photo on the front-cover of this issue of the journal depicts the argon three-phase point reappearance device, which is made by the Chinese Research Academy of Metrology. The research on the device began in 1978, and the finished product was certified by the State in May 82. Its short term reappearance property is $\pm$0.19mk and its credibility is 99 percent. It has an automatic pressure control system using liquid nitrogen for the constant temperature tank. The successful production of this device may be considered as timely preparation for the extension of the new international applied temperature standard in China. The electrical testing meter in the device is the UJ-42 potentiometer made by Shanghai Electrical Meter Plant.

6168
CSO: 4009/17

AUTHOR: ZHONG Qiyu [6988 0796 1946]
ZHAO Tiancong [6932 1131 1783]
HE Fuxu [0149 4395 3563]

ORG: All of the Department of Nonferrous Metallurgy, Central-south Institute of Mining and Metallurgy

TITLE: "A Study of Comprehensive Utilization of Polymetallic Sulfide Concentrates--The Leaching of Qibaoshan Polymetallic Pyritic Sulfide Concentrate by Chloride Solution"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL-SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 3, 1982 p 23

TEXT OF ENGLISH ABSTRACT: A series of leaching experiments was carried out for Qibaoshan polymetallic pyritic sulfide concentrate by using chloride solutions. Lixiviants of various compositions were used, and the leaching effects and potential changes of solution were compared. Test results showed that the lixiviants containing cupric ions were particularly applicable to leaching zinc-bearing complex sulfide concentrates. In two-stage counter-current leaching with $CuCl_2$ + $FeCl_3$ solution, the extraction rate of most metals was above 95 percent. The results obtained were discussed.

AUTHOR: ZHANG Zengrong [1728 2582 2837]

ORG: Department of Geology, Central-south Institute of Mining and Metallurgy

TITLE: "The Characteristics of Microstructures and C-axis Fabric of Quartz in a Ductile Shear Zone at Yongning Region, Yangchun County, Guangdong"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL-SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 3, 1982 p 38

TEXT OF ENGLISH ABSTRACT: The quartz microstructures developed in the migmatite ductile shear zone resulted from low temperature creep deformation at Yongning Region, Yangchun County, Guangdong. The C-axis fabric formed a small circle pattern with particular characteristics. The opening angles of the small circles are about 70°, and the direction of their axis is nearly parallel to the foliation. The preliminary studies both in the field and in the laboratory indicate that this kind of small circle may be formed due to intragranular glide of the (0001) $\langle 11\bar{2}0 \rangle$ system under axial extension.

9717
CSO: 4009/25

AUTHOR: ZHU Guang [3608 0342]

ORG: None

TITLE: "New Achievement in Comprehensive Utilization of Complex Sulfide Ores--Semi-industrial Experiment With Qibaoshan Pyrite Ores Proved Successful"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH - INSTITUTE OF MINING AND METALLURGY] in Chinese No 3, Sep 82 p 96

ABSTRACT: Commissioned by Hunan Provincial Bureau of Petrochemical Industry, the institute proceeded with experimental studies of the typical complex sulfide ores of Qibaoshan and succeeded in, finally, proposing the semi-industrial cyanfree ore dressing technique. The Qibaoshan deposit is mainly pyrite ores containing some copper and zinc. Having undergone many thermal fluid mineralization actions and several secondary reconstruction processes of oxidization leaching, its geological condition is extremely complex. The ores contain a large quantity of soluble salts, the dressing water is acid, and it is very difficult to separate the copper and zinc. These types of ores are rare in China or foreign countries. Since 1974, the Ore Dressing Teaching and Research Office of the Department of Mines of the institute has tested many dressing schemes for the ores before proposing the cyanfree technique. On 5-8 Jul 82, a Conference of delegates representing 28 departments and universities approved the pilot scheme and regarded it as comparable with the techniques used in the Zuozuoliang [transliteration] Dressing Plant of Japan and the Quemont Ore Dressing Plant of Canada. The Ministry of Chemical Engineering has been requested to certify the technique. It has been adopted as the technical basis for constructing the Qibaoshan Pyrite Mine of Hunan Province.

6248

CSO: 4009/25

AUTHOR: LI Feng [7812 7364]

ORG: None

TITLE: "The 6th National Laser Technology Report Conference Held in Tunqi City of Anhui Province"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 5, Sep 82 pp 430, 472

ABSTRACT: The 6th National Laser Technology Report Conference, sponsored jointly by China Society of Optics and China Society of Electronics was held on 6-9 May 82 in Tunqi City of Anhui. It was attended by close to 300 delegates representing more than 100 organizations all over the country. More than 460 papers were received and 130 of these were chosen for reporting in 4 separate special subject meetings; 27 of these papers dealt with laser physics, 51 with laser devices, 30 with laser components and single component technology, and 22 with laser applications and other aspects. Special subject discussion meetings were organized on laser applications, free-electron laser, laser biochemical effect, x-ray laser device, laser spectroscopy, etc; the delegates were free to select among these to contribute their own ideas. In response to a special request by some delegates, a discussion meeting on the special subject of laser safety protection was organized on the spot, and Doctor GUAN Chongwen [7070 1504 2429] of Shanghai Optical Instrument Center was invited to chair the discussion. Following negotiations between the Laser Specialty Committee and related organizations, it was resolved that Chengdu College of Telecommunications Engineering should prepare for the 7th National Laser Technology Report Conference to be held in 1984.

AUTHOR: GUANG Neng [1684 5174]

ORG: None

TITLE: "Joint Conference of the Standing Committee (Expanded) of China Society of Optics, and the Optics and Applied Optics Group of the National Science Committee"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese No 5, Sep 82 pp 444, 457

ABSTRACT: China Society of Optics and the Optics and Applied Optics Groups of the National [State's] Science Committee held a joint conference in Tunqi City of Anhui Province on 14-18 May 82. It was attended by 23 members of the Standing Committee of the society, 19 members of the optics group of the committee, 10 chairmen and deputy chairmen of various specialty committees. Two reports on the development of optics in China and a survey of laser applications were delivered. In the 3 year since the establishment of the society and the group, close to 1000 technicians and scientists of optics have participated in various symposiums. On the basis of these scientific exchanges, the Optics Information Group and the Optics Information Special Committee have conducted surveys of major experiences and characteristics of optics development in major industrially developed countries and wrote a report concerning opinions with respect to the development of optics in China. The establishment of specialty committees on color optics, high speed photography, photons, and optical films was officially acknowledged. It was resolved that the second conference of representatives of China Society of Optics will be held in late 83 in Beijing and about 400 persons should attend.

6168
CSO: 4009/14

AUTHOR: LIU Zaihai [0491 0961 3189]
WU Jiayang [2976 1367 2254]
SONG Yuxia [1345 3768 7209]

ORG: All of the Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "An Experimental Study of the Superconducting Solenoid Magnet"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 3, 1982 pp 243-248

TEXT OF ENGLISH ABSTRACT: An experimental study of the distribution of losses within a superconducting solenoid magnet and the effects of wire movement and shorts in the magnet on the critical current has been made. The experimental results obtained show that:
(1) The losses of the inside coils in a magnet are smaller than those of the outside ones. The sum of losses of the inside and the outside coils is equal to that of the whole magnet.
(2) The distortions in the shape of the hysteresis loop of a magnet are caused by either wire movement or shorts in the magnet. However, the two types of distortions are different from each other.
(3) Both wire movement and shorts will possibly lead to a decrease in the critical current of the magnet.
(4) The loss of a magnet due to the shorts within will possibly be twice, several times, or even more than that of the magnet without shorts.

AUTHOR: LING Dachun [5677 6671 2504]

ORG: Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "Simulating Calculations of the Current Lead Cooled Down by Gas"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 3, 1982 pp 249-256

TEXT OF ENGLISH ABSTRACT: This paper introduces the method of how to simulate calculations for the current lead cooled down by helium gas, yielding some profitable results. They include the minimum cooling power of liquid helium required per ampere for the current lead, the temperature distribution on it with various $\rho(0)$, the optimum condition between the current I, the dimensions of the lead L/S and the residual resistance ratio $\rho(0)$, etc. The choice of the best kind of copper materials for the current lead in DC or AC superconducting magnets is also discussed. These results can profitably be applied to designing the current lead.

9717
CSO: 4009/19

AUTHOR: YU Maohong [0205 5399 1347]
LE Meifeng [2867 5019 1496]
WU Guanghao [2976 1639 5714]
SHAO Yasheng [6730 0068 5116]
HUANG Deshu [7806 1795 2579]

ORG: YU, LE and WU all of Xi'an Jiaotong University; SHAO and HUANG both of the Shanghai Electrical Machinery Manufacturing Works

TITLE: "Magnetic Vibration of Large Turbo-generator Stators and Its Suppression"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, 1982 pp 425-436

TEXT OF ENGLISH ABSTRACT: The magnetic vibration problems of a large turbo-generator and the methods used for the suppression of severe vibration have been described. Using the energy method, the finite element method and the structural model analysis, we have systematically analyzed the natural frequency, mode shapes, dynamic response of generator stator frames and all the factors that affect the vibration characteristics of generator stators, such as the stiffening ribs, strengthening in the corner of the frame, the welding length, the stiffness of the foundation and the vibration-suppressor band.

[Continuation of GUTI LIXUE XUEBAO No 3, 1982 pp 425-436]

The results of the study have been examined in a power station. The largest vibrations of the generator stator frames were found to have been reduced from 140-260 μm to 10-30 μm in one set and from 90 μm to 10 μm in another.

9717
CSO: 4009/21

END

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INTERNATIONAL MEETING ON LASER MEASUREMENT OPENS IN BEIJING

OW251522 Beijing XINHUA in English 1509 GMT 25 Oct 82

[Text] Beijing, October 25 (XINHUA)--China has built up a length measurement system based on laser wavelength to serve precision processing, quality testing, and observation in scientific research. The accuracy of China's primary standard for length metrology has reached advanced world levels.

This was revealed at an international symposium which opened here today. At the symposium scientists from eight countries will discuss measuring lengths and angles with laser, computer, and other advanced techniques.

The International Symposium on Measurement of Geometric Quantities is sponsored by the Chinese Society for Measurement. Ninety-four metrologists from Japan, Britain, United States, China, and other countries are attending the 4-day symposium. The participants will contribute 42 papers.

Geometric quantities include parameters of size, form, and space distance. Measurement of geometric quantities is important for accuracy and quality of products, standardization, and scientific research.

Measurement by laser, optical grating, computer, and photo-electronic techniques has been developed since the 1960's. China has made much progress in the field, according to the symposium.

In an international comparison in Paris last June, China's value of primary standard for length metrology was very near to the average value, with an error of only 0.02 micron, or one-3,000th of a hair, which places the accuracy of China's metrology on advanced world levels.

China established its primary standards for length metrology in the 1950's and the early 1960's. In the mid-1960's, China started study of frequency stabilized laser for measurement.

CSO: 4010/18

FOSHAN SETS EXAMPLE IN TECHNOLOGICAL ADVANCE

OW302215 Beijing XINHUA in English 1244 GMT 30 Oct 82

[Text] Guangzhou, 30 Oct (XINHUA)--Foshan, a medium-sized city of light industry and textiles in Guangdong Province, has transformed or replaced 37 percent of its old equipment since 1979 with imported equipment and technology, according to provincial authorities.

It was able to do this with foreign investment absorbed in its processing and assembling business with foreign firms and through compensation trade.

This city furnishes a good example of how Chinese coastal enterprises could carry out technical transformation, the authorities said.

Between early 1979 and September of this year, the city imported about 7,000 pieces of equipment and 12 production lines through its processing and assembling business and compensation trade. The total value ran to U.S.$14 million. During this period the sum used for imports equalled to 83 percent of the total investment made by the state for the city's industrial growth over the past 30 years.

As a result, part of the equipment in the cotton textile, knitwear, porcelain, plastics, foodstuffs and electronic industries has been renewed or upgraded. Equipment for the garment and leather industries has been completely raised.

The local authorities said the city followed the principle of making imports serve the needs of economic readjustment, technical transformation of old enterprises and improved production performance and exports. Emphasis is put on equipment for light and textile industries, that helps conserve energy and raw materials.

The city's No 1 knitwear mill imported 230 pieces of equipment worth U.S.$286,000 to replace or renovate 70 percent of its sewing equipment and 40 percent of the weaving equipment and 60 percent of the dyeing equipment. The mill wrote off the investment in just 3 years. Profits also increased sharply.

The import of technology and equipment raised the city's industrial output value to 1,056 million yuan in 1981, an increase of 56 percent from 1978, averaging

16 percent per annum. The city's industrial output value in the first 9 months of the year reached 839 million yuan, an increase of 16 percent over the same period of last year.

Besides, the city's exports increased from 150 varieties in 1978 to 240 in 1981. The total value of export purchases rose from 98 million yuan in 1978 to 204 million yuan in 1981. In the first 9 months of this year, export purchase value came to 194 million yuan, a 26.4 percent increase over the same period of last year.

CSO: 4010/19

HIGH POLYMERS USED AS DRAG REDUCING AGENTS

Shanghai ZIRAN ZAZHI [NATURE JOURNAL] in Chinese Vol 5 No 7, Jul 82 pp 493-495, 510

[Article by Shi Guanyi [0670 6034 0001] of the Shanghai Organic Chemistry Institute of the Chinese Academy of Sciences: "High Polymers and Energy Resources"]

[Text] High polymer materials are macromolecular organic compounds synthesized artificially by chemical methods or by chemically changing the properties of natural products. They are mainly used to make plastics, rubber, fibers, paints, packaging materials and functional high polymer materials that have special properties and uses. They are widely utilized in every realm of the national economy and in every aspect of man's clothing, food, living and transportation. At present, the popularity of high polymer materials by volume of annual production has surpassed the sum of all metal products. High polymer materials are mainly synthesized from coal and petrochemical products. In this age of petroleum and energy shortage, why do we need to develop high polymer materials in a big way? To answer this question, we must naturally analyze the energy consumption of metallic, inorganic and high polymer materials, i.e., to find out whether the energy consumption in producing high polymer materials is higher or lower than other materials, and what relationship it has with energy conservation and the development and utilization of new and old energy resources? This article will describe high polymer materials as the material with the lowest energy consumption, high polymer drag reducing agents and energy conservation, high polymers and petroleum exploitation, and high polymers and new energy resources.

High Polymer Materials Consume the Least Amount of Energy

The specific gravity of high polymer materials is lower than metals, porcelains and cement. Using them to manufacture means of transportation can greatly conserve such energy resources as petroleum. At present, their strength, rigidity and durability are close, and high polymer materials with better properties than those of metals have already been manufactured. Therefore, we can use plastics to replace metal in manufacturing automobiles, airplanes and ships. Besides the engine, all-plastic automobiles have already been manufactured. It is expected that by the year 2000, every automobile will require 500 kilograms of plastics.

Although the raw material of high polymer materials is coal or petroleum, the raw material used for high polymer materials constitutes only a very small portion of the world's petroleum production. At present, petrochemical products constitute 5 percent of the world's output of petroleum. Of this 5 percent, only 1/3 is used as raw material for high polymer materials. At present, petrochemical products are changing from the present reliance on petro-olefines to carbon chemistry. Therefore, the consumption of petroleum as raw material for high polymer materials is gradually lessening. In addition, although metals, cement and glass use natural mineral deposits as raw materials, the amount of energy consumed in smelting, manufacturing and processing is much higher than that for high polymer materials. Table 1 lists the energy consumption of aluminum, steel, glass, paper and plastics. It can be seen from Table 1 that energy consumption by weight shows that plastic has a much lower consumption than other materials. Energy consumption by volume shows that because the density of plastic is lower than other materials, the energy consumption of high polymer materials is lower than that of other materials by several times. Table 2 lists the energy consumed to manufacture the same volume of bottles or containers for soft drinks. The energy consumption for manufacturing plastic bottles is the lowest. It is 20 to 30 times less than that for glass bottles and aluminum cans. Therefore, in nations using petroleum to generate electricity and as fuel, the amount of petroleum consumed to manufacture the same volume of metallic and non-metallic materials is actually much greater than that to produce plastic. In addition, waste plastic can still be used as fuel. For example, the thermal value of a waste polyethylene bottle of 2 liters in volume is 317 kilocalories. It is sufficient to boil 4 liters of water. Metallic and inorganic materials do not have any thermal value that can be utilized.

Table 1. Energy Consumption To Manufacture Various Types of Materials

Materials	Energy consumption (kilowatt.hour/lb)	Materials	Energy consumption (kilowatt.hour/lb)
Aluminum	33.6	Paper	3.2
Steel	6.3	Plastics	1.4
Glass	3.6		

Table 2. Energy Consumption To Manufacture Soft Drink Bottles or Containers of the Same Volume

Container	Weight (ounces)	Energy consumption (kilowatt.hour/unit)
Aluminum can	1.41	3.00
Glass bottle	8.83	2.00
Steel bottle	1.76	0.70
Paper milk carton	0.92	0.18
Plastic bottle	1.23	0.11

High Polymer Drag Reducing Agents and Energy Conservation

Today, pipes are widely used in industry to transport fluids. For example, oil pipes are used to transport petroleum. The chemical industry uses pipes to transport organic fluids and fuel. Water circulates in pipes to cool boilers. Water hoses are used to put out fires. But fluids flowing in pipes must overcome drag, therefore it must consume energy. How to conserve this energy has naturally become a problem of concern in industry.

When fluids flow inside pipes, turbulence frequently occurs. This is the main cause of drag and increased energy consumption. Adding a small amount of high polymer substance in the fluid can suppress turbulence and thus reduce the drag of the flow and greatly conserve energy. The earliest report of using high polymers to reduce drag was by Toms. He discovered in 1948 that after adding 0.25 percent of polymethyl methacrylate in chlorobenzene, the drag in the flow in pipes was 50 percent less than before it was added. About the same time, Mysels also discovered a similar phenomenon. He measured the pressure drop in the flow of aviation gasoline inside capillary tubes before and after adding aluminum soap. When the condition for turbulence was reached, the pressure drop in a unit length of pipe after adding aluminum soap was smaller than before.

After this, oil field workers discovered that guar gel extracted from plants (a kind of macromolecular polysaccharide) has a visible effect in reducing drag in water. When extracting petroleum in the oil fields, large amounts of water containing sand must be pumped into the wells to increase the pressure in the underground oil layers and break the oil-containing rocks. At first, guar gel was used as the thickening agent to suspend the sand in water. But it was discovered during the course of use that after adding 0.1 percent to guar gel, the energy of the pressure pump could be reduced 70 to 80 percent. This showed that the drag of the flowing water containing guar gel was greatly reduced. Later, polypropyrene amide and such synthetic polymers were discovered and found to reduce drag in water. In 1962, Fabula also discovered that after adding polyoxyethylene in water, the drag of the fluid visibly reduced. This is the most effective high polymer drag reducing agent at present. Adding several million parts in water can produce visible results.

The effect of reducing drag in fluids by polymer drag reducing agents is related to the molecular weight, the degree of dissolution, the concentration, the diameter of the pipes and the speed of flow. But the foremost condition is that the polymer drag reducing agent must be able to be dissolved completely in the fluid, i.e., the fluid should be a good solvent of the high polymer used to produce a reduction in drag. The molecular weight of the polymer should surpass a critical value (about 100,000) before it has a drag reducing function. The higher the molecular weight, the better the effect of reducing drag and the lesser the concentration. Polyoxyethylene mentioned above has a molecular weight reaching several million and even surpasses 10 million, therefore the amount required can be as little as several million parts. Generally speaking, high polymers used as drag

reducing agents should be linearly flexible molecules of the high polymer. The drag reducing effect of any high polymer is closely related to a fluid's speed of flow. When a fluid flows slowly in a pipe, turbulence is not produced. At that time, there is no visible drag reducing function. As the speed of flow increases, turbulence is formed, and the drag reducing function begins to show itself. When the speed of flow reaches a definite value, the drag reducing effect is the best. Under the most favorable condition, 70 to 80 percent of the energy can be conserved. When the speed of flow continues to increase, this value continues unchanged. The efficiency of polymer drag reduction can be expressed as:

$$\text{Percentage of drag reduction} = \frac{\Delta P_s - \Delta P_p}{\Delta P_s} \times 100$$

where ΔP_s is the pressure drop produced by friction when the fluid flows through a unit length of pipe; ΔP_p is the pressure drop produced after a high polymer is added in the fluid when it flows through a unit length of pipe. If this value reaches 80 percent, this means the energy consumption can drop to 1/5 the original. This is a very sizable figure.

1. Several Commonly Used High Polymer Drag Reducing Agents

(1) Guar Gel. It is a natural polysaccharide consisting of mannose and galactose. It can be used as a food additive and thickening agent. When used in the petroleum industry as a suspension agent for pressurizing and cracking liquid, it was discovered that the drag of the flow of its water solution was smaller than pure water, it did not degrade under a very high shearing velocity, and its viscosity did not drop in salt water. These properties have enabled guar gel to be used widely in petroleum extraction. Sesbania gel extracted from the seeds of sesbania in our nation has a similar chemical structure as that of guar gel and it has also been widely used in the development of our nation's oil fields. Guar gel or sesbania gel that has not been denatured is difficult to dissolve in water. After carbonyl methylation, it acquires a quick dissolving property. Therefore, denatured plant gels are also frequently used in oil fields.

(2) Polyoxyethylene. Its drag reducing efficiency is the highest among all polymers, i.e., the concentration required to reduce a definite drag is lower than that of all other polymers. If one one-millionth is added in water, the drag during flow will be reduced by 20 percent. Adding 25ppm can reduce the drag by 75 percent. This high polymer has a linear structure. It can produce a drag reducing function in all its solvents such as water, benzene, carbon tetrachloride, chloroform, trichloromethane. Tests show that after adding polyoxyethylene in salt water, glucose, plasma, the blood pressure can be lowered.

(3) Polypropyrene amide. Its drag reducing efficiency is between that of guar gel and polyoxyethylene, but it is more easily dissolved in water, therefore in cases where a quick dissolving property is required, this type of polymer can be used. Through partial solution in water to increase its

molecular weight or using large hydrophilic side radicals, we can increase its drag reducing performance.

(4) Other Polymers. Carbonyl methyl cellulose sodium salts, carbonyl ethyl cellulose, polystyrene sodium sulfonate, are drag reducing agents of water solutions. Polyisobutylene is the drag reducing agent of crude oil, fuel oil and cyclohexane. Polymethyl methacrylate is the drag reducing agent for such organic solvents as methylbenzene.

2. The Uses of Drag Reducing Agents

The function of drag reducing agents is to reduce the drag of a flowing fluid and realize the goal of conserving energy. It is being used more widely. The addition of polyisobutylene in petroleum transported in oil pipes can conserve energy and increase the speed of flow. At present, the problem of degradation of polyisobutylene during the course of flow is being solved. After adding polyoxyethylene in water, the output velocity of water in putting out fires can be increased fourfold. Tests show that after adding 200 ppm of polyoxyethylene in water, the pressure drop in a hose of 700 feet long can be reduced by 40 percent, therefore, when the pumping rate remains unchanged, the height of the water from the fire extinguisher can be increased 50 percent while the amount of flow can be increased 10 percent, and the water column is not easily scattered by wind. The water flow can be concentrated within a very small area and this greatly improves the efficiency of putting out fires.

Speed boats that navigate sea waters and that are equipped with spouts that spray a polyoxyethylene water solution into the surrounding water can reduce drag during navigation and increase traveling speed.

Adding polyoxyethylene in the cooling water of boilers at power plants can increase the efficiency of the boiler because of faster water flow.

High Polymers and Petroleum Extraction

Contrary to general understanding, underground petroleum does not come from oil pools. It is deposited in porous sandstone or limestone. Oil frequently coexists with gas. The pressure in the underground oil layers often reach several thousand pounds per square inch. After an oil well is drilled, the underground pressure can spew out the petroleum. In this way, 15 to 20 percent of the underground oil reserves can be extracted. To maintain a high underground pressure so that more oil can be extracted, water injection is frequently used. This is to inject sand containing water under very high pressures into the well to drive the oil from underground.

Although water is present everywhere and is cheap, and its viscosity is also close to that of oil, it is not an ideal oil driving liquid. Because water and oil cannot dissolve each other, frequently small amounts of oil from rock crevasses are driven out by water and the oil exists as small scattered drops in the water. Water does not easily penetrate rock pores that contain large

amounts of oil. Also, the viscosity of water is not large enough, and water easily flows past the rocks along the path of least drag. In this way, what is gathered after injecting water is not oil but a water and oil mixture containing large amounts of water. When the ratio of water and oil in that mixture surpasses 20:1, injecting water would have no economic value.

To produce more oil, we must block the water to drive the oil, this means, to reduce the speed of loss of water from the rocks and drive the oil out. The most effective method is to add water soluble high polymers in the water, such as partially dissolved polypropyrene amide or natural polysaccharides in the water. The speed of the fluid passing the rocks and the permeability k of the fluid in the rocks is related to the viscosity η. The higher the viscosity of the fluid, the smaller the permeability, and the slower the speed it passes over the rocks. After adding less than 0.5 percent of polypropyrene amide in water, the viscosity increases, the permeability decreases, and the water and oil ratio actually determined in the extracted petroleum is the active ratio of water and oil in the rocks $M=(k_{water}/\eta_{water}) / (k_{oil}/\eta_{oil})$. Before adding the polymer, M is higher than 10 to 30, i.e., the speed of water passing over the rocks is larger than that of oil by the same multiple. Therefore, what is mainly extracted is water, not oil. After adding the polymer, M can drop to 1 to 2, and compared to the pure water injection method, after adding water soluble high polymers in water, 80 percent more oil can be extracted.

There are two types of water soluble high polymers frequently used in oil field exploitation: One is a synthetic polymer represented by polypropyrene amide. Its molecular weight is high and after partial dissolution in water, the molecules carry an electrical charge. It is a high polymer electrolytic substance, therefore, it has a very high viscosity in dilute solutions. Also, the partially dissolved polypropyrene amide water solution is a non-Newtonian fluid, i.e., its viscosity in high shear velocity (equivalent to the situation of high pressure injected water flowing through pipes) is very small. The viscosity is about the same as that of water, therefore energy can be conserved. Under a low shear velocity (equivalent to flowing in rock crevasses), its viscosity is very large, several dozen to a hundred times larger than the viscosity of water. Therefore, it is used the most in oil wells but its shortcoming is that it is not suitable for use in salt water, especially water containing bivalent calcium and magnesium ions.

Another type is natural polysaccharides, including guar gel and sulfoids. The latter is formed by microorganic fermentation of hydrocarbons. Polysaccharides are expensive and they are easily degrated by microorganisms, but they can be added in salt water or they can still function when the oil layers contain salt water.

Because the traditional method of oil extraction (including the water injection method) can only extract one third of underground deposits of oil, therefore, at present, all oil producing nations in the world have invested a lot of money to study ways to improve the oil extraction rate. Adding water soluble polymers in injected water is only one method.

In addition, there are also methods of using carbon dioxide, surface activators and alkaline water to drive oil. The method of using carbon dioxide to drive oil is to inject carbon dioxide in place of water into the geostrata. But the viscosity of carbon dioxide is very low. To increase viscosity, we should add polymers that are soluble in carbon dioxide or make the water that contains carbon dioxide, surface activators and polymers into a foam and then drive the carbon dioxide or its foam into the geostrata. However, water containing polymers must also be injected. When using surface active oil and water mixtures and alkaline water to extract oil, a large amount of polymer-containing water must be injected after injecting the above fluids to reduce cost and to drive the above fluids into the rocks.

Therefore, all measures to improve the rate of oil extraction must use a large amount of water soluble polymers. At present, the United States uses over 10,000 tons of high polymers each year in oil extraction to improve the rate of oil extraction. It is estimated that the need will quickly reach 40,000 to 50,000 tons. In recent years, the United States has already established plans to improve the oil extraction rate in oil fields. Investment in improving the oil extraction rate using polymers has surpassed 100 million U.S. dollars.

High Polymers and New Energy Resources

Chemical energy resources are of only two types: One type is the non-reproductive battery that converts chemical energy into electrical energy, or the rechargeable battery. The other is the photogenic voltage battery that converts solar energy into electrical energy.

Although not long ago, all materials related to chemical energy resources were metallic or inorganic, and organic high polymer materials were used only as outer shells or casings, but in recent years, the development of organic metals has caused a fundamental change. Since 2 to 3 years ago when polyacetylene was discovered, and since the development of organic polymers with a common valence bond that can be impregnated by chemical methods to form p-type or n-type semiconductors and organic metals, high polymers have acquired a broad future in energy applications.

The polyacetylene film is originally an electrical insulator. Its electrical conductivity is about $10^{-9}\Omega^{-1}$ cm^{-1}. But when it is impregnated with a strong oxidizer or a strong reducing agent, its electrical conductivity can be increased by 12 magnitudes. After impregnating 1 mol percent of impurities, a change from semiconductor to metal occurs. When the concentration of the impurity continues to increase (1 to 10 percent), the electrical conductivity increases very slowly and under room temperature, the electrical conductivity finally reaches $10^{3}\Omega^{-1}cm^{-1}$. Its density-electrical conductivity ratio (the ratio between electrical conductivity and density) is about the same as that of mercury, about 100 times smaller than that of good conducting copper. Because of this characteristic, it is possible for polyacetylene to replace metals as a material for electrodes. If we use a polyacetylene film of 0.1 mm thick as the anode and platinum as

the cathode in a CH_2Cl_2 solution of such quaternary ammonium salt solutions as a KI water solution or $[(n\text{-}C_4H_9)_4N]^+(ClO_4)^-$ and pass a 9V voltage through it for 30 to 60 minutes, the polyacetylene will reach a metallic state. The electrode reactions are as follows:

$$\text{Anode } (CH)_x \longrightarrow (CH^{+y})_x + xye^-$$

$$\text{Cathode } xy[nC_4H_9)_4N]^+ + xye^- \longrightarrow xy[nC_4H_9)_4N]_x$$

After charging, electrical discharge can cause the electrode reactions to reverse. Such a battery has a voltage of 3.7V during discharge. The short circuit current is 25mA, and only 0.5 square centimeters of polyacetylene is needed as the material for the electrode and the weight is less than 2mg. After charging and discharging 326 times, the current voltage characteristic remains unchanged. The polyacetylene film will not change.

Why does polyacetylene film used as a material for electrodes have so many advantages, such as a high energy density, quick charging and discharging characteristics, light weight and small volume etc.? This is inseparable from the characteristics of the polyacetylene film. The polyacetylene film synthesized by chemical methods is actually not a dense film. Under the electron microscope, we can see that it is formed by a network of filaments of 200Å long. There are many empty spaces inbetween. Therefore, it has a very large surface area. A polyacetylene film 0.1 mm thick and having an area of 1 square centimeter has an effective surface of about 2.5×10^3 square centimeters while the weight is only 3 mg. Such a large surface area and such a light weight have made polyacetylene an ideal electrode material.

In actual use, polyacetylene can be used as the anode and the cathode material at the same time. When using an organic solvent such as CH_2Cl_2 or carbonic propenyl ester as the solvent and a quaternary ammonium salt as the electrolytic medium, the following cathode reaction occurs:

$$\{CH=CH\}_n + R_4N^+X^- \longrightarrow [\{CH=CH\}_n{}^{\cdot+}X^-] + R_4N^+ + e$$

The polyacetylene on the cathode reduces:

$$\{CH=CH\}_n + R_4{}^+NX^- + e \longrightarrow [\{CH=CH\}_n - R_4N^+] + X$$

During electric discharge, the above electrode reactions reverse and electrical energy is produced. Such a battery has a bright future for development. It may possibly be used in the automobile industry.

Because we can obtain p-type and n-type materials after impregnating polyacetylene by I_2, Br_2, AsF_5, $AgClO_4$, naphthalene sodium and many such oxidizers or reducing agents, and because the absorption band of polyacetylene is within the visible light wavelengths, therefore, there is a future for developing the use of polyacetylene to manufacture photogenic voltage batteries to convert solar energy into electrical energy. At present, people are

already studying combinations of inorganic semiconducting materials and polyacetylene to make solar energy cells, such as the battery composed of p-type polyacetylene and ZnS which has an open circuit voltage of 0.8V, and the battery composed of the p-type polyacetylene and the n-type silicon chip which has a voltage of 0.395V and an efficiency of 75 percent.

It has only been 4 to 5 years since the discovery that impregnated polyacetylene can become a semiconductor and a conductor. Work in this regard is very active.

Besides polyacetylene, many other polymers such as polybenzene, polybenzene acetylene, polybenzene sulfur ether which can also become semiconductors and conductors after impregnation have been discovered. It is expected that in the not-to-distant future, high polymer materials will realize even greater breakthroughs in the development of new energy resources.

9296
CSO: 4013/148

BRIEFS

UNIVERSAL TIME SYSTEM--The universal time system established by China through its own scientific research efforts has maintained an advanced world level for years. It won second prize in the state natural science awards at the National Scientific and Technological Awards Meeting held in Beijing on 23 October. This system was mainly the result of research efforts by Shanghai Astronomical Observatory, with the cooperation of the Purple Mountain Observatory, the Beijing Observatory, the Wuchang Time Station of the Chinese Academy of Sciences, and the Yunnan Observatory. The precision of measuring time has been constantly increasing, with the long-period constancy reaching 1.3 milliseconds and the system's internal precision reaching 1 millisecond in recent years. [Shanghai City Service in Mandarin 1130 GMT 23 Oct 82 OW]

CSO: 4008/21

AUTHOR: LIU Bingren [0491 4426 0088]
LI Shoushan [2621 1343 6365]
WAN Shanshan [8001 3790 3790]
GU Rongkun [7357 2837 0981]

ORG: All of Department of Transportation, Shandong Province

TITLE: "Design and Construction of Huanghe Bridge in Jinan"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese No 3, Sep 82 pp 1-9

ABSTRACT: The highway bridge across Huanghe in Jinan measures a total of 2023.4 m in length, with the main bridge consisted of 5 spans of 40 + 94 + 220 + 94 + 40. The middle span crosses the major channel of the Yellow River in a cable-stayed prestressed concrete girder, measuring as long as 220 m. On both ends, the approaches are composed of 30 m spans to measure a total of 1535.4 m. The bridge is 19.5 m in width, with a net vehicle runway of 15 m. The earthquake resistance is provided to 7 magnitude. The construction of the bridge began in Dec 78; assembly of the structure was preliminarily completed in Dec 81. After load testing, the bridge was officially open for traffic on 14 Jul 82. The total investment was 36.10 million yuan. The quantity of materials used and the economic indices are given in a table. The construction control measures and the result are stated. The economic benefit of optimal design of the closely spaced stay-cables is considered not obvious. Future studies are awaited with respect to simplification of design computation, the effect of creep, and the problem of corrosion prevention of the cables.

AUTHOR: ZHANG Guoxia [1728 0948 7209]
CHENG Jida [4453 1323 6671]
SU Liren [5685 4539 0088]
ZHANG Kexu [1728 0344 4872]

ORG: ZHANG of Beijing Municipal Survey Department; CHENG of Beijing College of Construction Engineering; SU of Beijing Municipal Academy of Construction Designing; ZHANG of Research Institute of Engineering Mechanics, Chinese Academy of Sciences

TITLE: "Earthquake Response Analysis of the Foundation and Superstructure of Beijing Railway Station High-Rise Waiting Room"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese No 3, Sep 82 pp 64-71

ABSTRACT: The foundation of the high-rise waiting room of the Beijing Railway Station is partially on the abandoned river channel, consisting of silt type soft clay. During the construction period, due to excessive settling, the silicate consolidation process was applied. After the project completion, settlement continued to increase, however. Following the Xingtai Earthquake of 1966, a study on the necessity of a thorough reinforcement of the entire foundation was carried out, along with an analysis of earthquake response of the foundation, the superstructure, the clay, and their interaction. Based upon the result of computation and analysis, a decision against reinforcement was reached. The finite-element method used in the analysis and the conclusion are introduced in the paper.

6248
CSO: 4009/26

AUTHOR: YAO Tianshun [1202 1131 7311]
WANG Baoku [3769 1405 1655]

ORG: Both of the Software Engineering Teaching and Research Group

TITLE: "The Principle of Radicals Recomposing for Chinese Characters and Its Process Program"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 3, Sep 82 pp 55-65

TEXT OF ENGLISH ABSTRACT: Chinese characters originate from ancient pictographs. Almost all Chinese characters can be broken down into two or more radicals (components), as viewed from the pattern structure of a character, but a few are of a single radical only. For the purpose of inputting Chinese characters into a computer, a number of research works on character recognition involving the choice and recomposing sequence have been done over the years. An existing problem is that a total of so many radicals (i.e., up to 616) is difficult to learn and operate on a corresponding keyboard. This paper is written as an attempt to establish a recomposing principle for Chinese characters and to offer a processing program in order that an untrained person may apply it. Based on a thorough analysis of the popular "Xinhua" dictionary which includes about 9,000 often-used characters, the paper puts forward a new Chinese character system in which each character is classified as one of five kinds and so the

[Continuation of DONGBEI GONGXUEYUAN No 3, Sep 82 pp 55-65]

total number of radicals is reduced to fewer than 160. Each of the characters in this system can be represented by 1 to 12 radicals but, in general, 7 fundamental radicals are sufficient to recognize most characters. Thus, an all-purpose Chinese information processing program available for use is offered. Suppose the key space consists of integral values in the interval (a,d) and is divided into j subintervals of a length l. The frequencies and cumulative frequencies are calculated and, transformed by a piecewise linear function, are well-distributed in the address space. A method is also given to resolve the problem of collision. The authors wish to reduce the radicals to 100 keys on a keyboard in the near future.

AUTHOR: ZHANG Xiuzhen [1728 4423 3791]

ORG: Northeast Institute of Technology

TITLE: "All-China Planetary Gear Drive Symposium Held at Northeast Institute of Technology"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 3, Sep 82 p 66

ABSTRACT: The All-China Planetary Gear Drive Symposium was held at Northeast Institute of Technology from 17 to 21 August 1982. The symposium was cohosted by the Xi'an Heavy Machinery Research Institute. Seventy-nine specialists, professors, engineers, etc., from 49 institutes throughout the country attended, and 63 papers were presented. Among these, Li Huamin [2621 5478 2404] of the Harbin Institute of Technology reported on the International Gear Convention held in Tokyo in 1981. Engineer Chen Zixiu [7115 5261 0208] of the Xi'an Heavy Machinery Research Institute and Assistant Professor Zhang Shaoming [1728 1421 0682] of the Xi'an Highway College reported on the planetary gear situation in China and abroad, and made suggestions for improvements. The delegates engaged in vigorous discussions on how to promote work in this field in our country, and a report on that subject was approved for submission to higher authorities.

9717
CSO: 4009/23

AUTHOR: YONG Yan [0737 4291]

ORG: None

TITLE: "A New Budding Technique of Photography--Neutron Photography"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 8, 1982 pp 6-7, 32

ABSTRACT: The development of modern science and technology has caused great changes in photographic technology also, including, for example, the emergence of x-ray photography, laser photography, sonic wave photography, etc. and the newest technique of neutron photography. This paper introduces briefly the strange properties and characteristics of neutrons, the realization of neutron photography through the use of a converter screen, and the current research in foreign countries on the use of electron image display technique in neutron photography. Applications of neutron photography in archaeology, medicine, aviation, weapons industry, nuclear science, industrial production, etc. are briefly explained. Photos are included depicting a portable neutron camera, photos of bullets taken by neutron photography and x-ray photography, and a neutron photo of a bronze statue of buddha. Finally, the paper mentions casually that research on neutron photography is being developed in China in recent years and some preliminary results have been obtained without referring to any specifics.

AUTHOR: XU Ce [1776 3261]

ORG: None

TITLE: "Double-pulse Laser Holographic Camera"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 8, 1982 p 16

ABSTRACT: Beijing Research Institute of Photoelectric Technology has succeeded in making the dynamic holographic camera equipment with the double-pulse ruby laser device as the light source. The equipment is mainly used for tests in mechanics, in space navigation industry, and in precision machine engineering. Through fast recording of all transitional states, such as vibration, morphological changes, stress propagation, flow field, etc., this photographic technique makes it possible to obtain mechanical parameters for the analysis of dynamic conditions. Characteristics of this photographic equipment are also very briefly compared with those of cameras using ordinary continuous laser device as the light source. This new equipment has been certified.

AUTHOR: None

ORG: None

TITLE: "The Second Congress of Representatives of China Society of Instruments and Meters Will Soon be Held"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 8, 1982 p 32

ABSTRACT: The second Congress of Representatives and the Annual Conference of the China Society of Instruments and Meters will be held simultaneously this year in November in Beijing. The achievements and experiences of the past 3 years since the establishment of the society through its various activities will be summarized, its second board of directors elected, and its future activity plan discussed and formulated. During the conference time, close to 100 papers will also be exchanged to review all important accomplishments in scientific research and production of instruments and meters in China and to prepare for the multi-country symposium of instrumentation and meters technology to be held in Shanghai in Apr 83. This November conference will be attended by more than 300 delegates including the old specialists and the middle-aged and young scientists and technicians of the instrumentation and meters technology in China. At present, all items of preparation work of that conference are being tensely but smoothly readied

6168
CSO: 4009/28

AUTHOR: XU Ce [1776 3261]

ORG: None

TITLE: "Ion Film Coating Equipment"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 9, 1982 p 28

ABSTRACT: The Beijing Instument Plant has succeeded in making the DML-500A ion film coating equipment. It is a new tool combining vacuum plating and vacuum sputtering to produce a coat of either single substance film or a film of a chemical compound of high adhesion. The technique does not pollute and provides a simple treatment for parts with a coat of film having very few pores. It has extensive applications in light industry, machine industry, electronic industry, research organizations, and universities. Its major components and chief technical indices are introduced.

AUTHOR: FU Wenyao [4569 2429 6460]

ORG: None

TITLE: "Multi-function Digital Speed-measuring Instrument"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 9, 1982 p 28

ABSTRACT: Joint research by Tianjin Cotton Spinning and Weaving Plant No 3 and Tianjin Electronic Instrument Plant No 2 has succeeded in making the ED-101 portable type AC-DC multi-function speedometer. It has a 5-place digital display system. When it is used in combination with a special detecting device, it has the following 5 testing functions: (1) Contact type low and intermediate speed measurement of 0-4000 rotations/min; the display is divided into 0.1 rotations/min and 1 rotation/min. segments.) (2) Noncontact intermediate and high speed measurement for less than 40,000 rotations/min and a maximum of 150,000 rotations/min.) (3) Contact type surface speed measurement; (4) Digital measurement; (5) Determining relative values (rate of extension, rate of drawing, etc.) Its measurement error is not greater than $\pm$0.2 percent + 1 of the read out. The instrument has been inspected by China Academy of Metrology and Tianjin Municipal Institute of Metrological Management and deemed to be qualified. After 1+ year of small-batch production and trial applications, it has received a joint certification from Tianjin Municipal Bureau of Textile Industry and Bureau of Machine Industry No 2 and will be produced in batches by Tianjin Electronic Instrument Plant No 2 mainly for tests of rotary and linear speed in textile or other industries.

6248

CSO: 4009/29

AUTHOR: SUN Zongying [1327 1350 4481]

ORG: Research Institute of Machine Tools, Ministry of Machine Industry

TITLE: "Comments on the Speedy Adoption of International Standards in Machine Tool Industry"

SOURCE: Beijing JICHUANG [MACHINE TOOL] in Chinese No 9, Sep 82 pp 41-43

ABSTRACT: China was accepted as an official member of the International Standardization Organization (ISO) in Sep 78. The Chinese National Bureau of Standards asked the Research Institute of Machine Tools to take on the work of coordinating with the ISC/TC [Technical Committee] 39 (concerning machine tools.) The standards of the machine tool industry in China were adopted in the 50's from these of the USSR. Although these standards did contribute to the economic construction in China during the first 5-year plan, after the 60's they can no longer meet the needs of the four modernization construction and the international machine tool market. At present, the precision standard of some machine tool products of China are behind the ISO standards, yet the products of such factories as Shanghai Heavy Machine Tool Plant, Changcheng Machine Tool Plant, Jinan Plant No 1, etc. can all match the ISO standards or better. The author; therefore, believes that it is entirely possible for China to implement the ISO standards. He suggests the adoption of following measures: (1) Translate documents of the ISO standards; (2) Serious analysis of ISO standards and use them to check domestic products; (3) Update work processes; (4) Provide needed high precision and high efficiency molds and other apparatuses; (5) Strengthen management; (6) Establish inspection centers; (6) Practice the system of higher price for higher quality; (7) Participation in international activities.
6168

CSO: 4009/18

AUTHOR: XU Peirong [1776 1014 2837]
JIANG Changsheng [5592 2490 3932]
LIU Xinzhong [0491 0207 0022]

ORG: XU of Nanchang Heat Treatment Plant; JIANG of Jiangxi University; LIU of Jiangxi Provincial Electric Power Repair and Manufacture Plant

TITLE: "Energy Conservation Realized Through Improving Heat Treatment Work Process"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 9, 25 Sep 82 pp 39-44

ABSTRACT: Heat treatment is a work process requiring the consumption of large amount of energy.The paper suggests that measures taken in the 3 following aspects can reduce the energy consumption in the heat treatment procedure: (1) Equipment meaasures; including application of heat insulating materials, utilization of waste heat, application of meters, etc.; (2) Measures of materials: including selective use of fast carburizing steel, steel used for isothermal quenching, steel used for direct normalizing, etc. (3) Measures of work technique, including shortening the duration of temperature maintenance, improving the carburizing process, subthermal, isothermal quenching, residual heat quenching forging, reducing or omitting the tempering process, etc. Energy saving methods of the 3rd category are introduced in detail in the paper.

AUTHOR: LIU Guoyan [2692 0948 3508]

ORG: None

TITLE: "1982 Annual Heat Treatment Meeting of Shanghai Branch Heat Treatment Society Held"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 9, 25 Sep 82 inside backcover

ABSTRACT: The annual meeting on heat treatment, sponsored jointly by the Heat Treatment Branch of Shanghai Municipal Society of Mechanical Engineering and the Heat Treatment Group of Shanghai Municipal Society of Metals, was held on 24-26 Jun. More than 50 papers were read at the meeting; they reflect new fruits in scientific research and production techniques of heat treatment in Shanghai. For example, Shanghai Research Institute of Steel and Iron succeeded in making the 100Cr2W steel for cold rollers to cause the useful life of the rollers to be several times longer. Shanghai Machine Manufacturing Work Process Center's vacuum sputtered titanium nitride can be used to plate ceramics. Shanghai Jiaotong University and Shanghai Heat Treatment Plant have sueneeded in their experiment with controlled nitriding to cause the useful life of molds, worm shafts, etc.to be several times to more than 10 times longer. All papers were well received at the meeting.

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CSO: 4009/22

END

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CHINA REPORT

SCIENCE AND TECHNOLOGY

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AERIAL TEAMS PROVIDE DATA FOR IMPROVED MAPS

Lanzhou GANSU HUABAO [GANSU PICTORIAL] in Chinese No 5, 1982 pp 4-5

[Article by Lo Wenke [5012 2429 4430] and Zhu Yenming [2612 1693 2494]:
"The Eagles of Aerial Surveying"]

[Text] Working round the clock in the skies of the motherland, a team of aerial surveyors who provide geographic and cartographic information for China's socialist, economic, and defense construction.

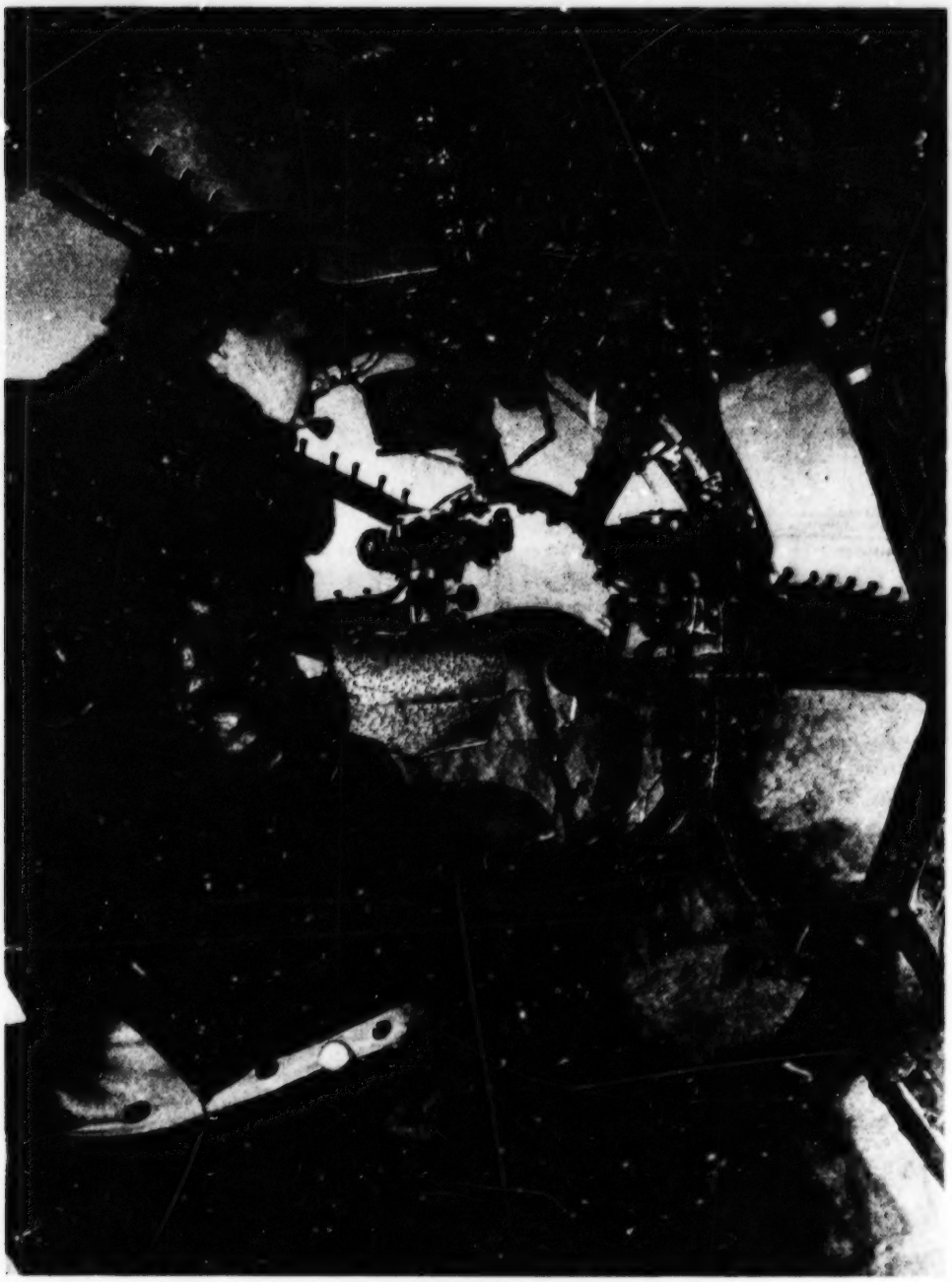
Shortly after its organization, this aerial survey team was given a difficult assignment to survey an important region. It was a region with complex terrain, high mountains and deep valleys, and the surveying aircraft must fly at low altitude through many uncalibrated peaks. Faced with this dangerous and difficult task, the young "eagles of aerial surveying" were put to the test, like young swallows learning to fly. However, armed with determination and courage, they ultimately established numerous air routes over the mountains and successfully accomplished their mission.

During the past 2 decades, the aircraft of the aerial survey team have cast their shadows all across this land: from the snowcovered forests of the northeast to the Yungeui highlands in the southwest; from the towering Kunlun mountains to the south sea islands; and from the Gobi Desert to the "Roof of the World."

Flying across thousands of miles of blue sky, the agile "eagles of aerial surveying" have just one goal in mind: to construct newer and better maps for the modernization of the motherland.

Preflight checkout.

Tension mounts during aerial photography.



Navigating.

3012
CSO: 4008/19

SUCCESS OF 'Y-7' ENCOURAGES PROPONENTS OF INDEPENDENT AIRCRAFT INDUSTRY

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 10, 6 Oct 82 pp 1-5

[Article by Xie Chu [6200 4342]: "A Flight in the 'Y-7'"]

[Text] In early April of this year, at the Zhanguei zhuang Airport in Tianjin, the Chinese-made "Y-7" aircraft successfully passed its most difficult tests before design certification; single-engine full-load take-off and landing tests. The success of this flight test not only makes a significant contribution to single-engine take-off and landing techniques but also paves the way for the "Y-7" to be certified for service.

After the flight test, the "Y-7" was flown to Beijing from Tianjin. At the invitation of the comrades at the Xi'an Airplane Company, we arrived at an airport in the suburbs of Beijing for a look at Chinese-made short-range passenger aircraft.

Inside the airport lounge, we were first treated to a colored video recording, which showed the reception for the "Y-7" test pilots by leading comrades of the State Council on 16 April of this year. Comrades Geng Biao and Zhang Aiping expressed their satisfaction with the aircraft's superior performance during the flight test and congratulated all the personnel of the aviation industry and civil aviation for their participation and achievements in this flight test. Declared comrade Zhang enthusiastically: "The 'Y-7' has now grown into a 'handsome young man'!"

The recording also showed the exciting scenes from the flight test. The chief engineer of the Xi'an Airplane Company and leader of the flight test team, Comrade Yi Zhibin gaves us a description of the development process of the "Y-7." According to him, "Y-7" is a twin-engine turboprop airplane designed to serve the transportation needs of feeder routes; its development was personnaly approved by the late Premier Zhou Enlai. At present, a total of nine "Y-7's" have been produced, two of which were used for strength tests, one was used in a fatigue test, and three were used in flight tests; a large amount of data was obtained from these tests. This aircraft has accumulated over 1,600 flight hours in more than 3,600 flights. The fuselage fatigue test is still continuing, with more than 52,000 test cycles completed.

It has been said that aeronautics is the "flower of modern industry." The successful development of the "Y-7" reflects the overall capability and standard of China's industrial and production technology. A passenger aircraft of the same class as the "Y-7" has approximately 600,000 parts, and each part must be of high quality. To produce so many parts requires thousands of different materials. With the cooperation of several hundred organizations all over the country, thousands of items were produced for the "Y-7"; the suppliers include the metallurgical, chemical, electronic, structural, mechanical, textile, and other industries. Therefore, it can be said that the "Y-7" is a product of socialist cooperation; its success is a result of supporting efforts from many industries.

Directly in front of us appeared a light-weight, agile-looking aircraft. Its white body was shining under the sunlight. On the 23 meter long fuselage were painted dark blue stripes and the eye-catching insignia of Chinese Civial Aviation; on the 8-meter-high vertical tail a colorful 5-star red Chinese flag made us feel proud to know that it is a Chinese-made aircraft. Spectators surrounding the airplane included comrades from the Central Committee.

The Y-7 is a medium-sized aircraft with a capacity of approximately 50 passengers. The cross section of the fuselage is composed of two circular arcs with different diameters; it has an all-metal semi-rigid structure made of frames and purlins covered with an aluminum skin. The wing span is over 29 meters; it is a cantilevered single wing located on top of the mid-section of the fuselage. Two 2,900-hp turboprop engines (WJ5A-1) are installed in the engine housings underneath the port and starboard wing sections.

The high wing design is commonly used on this type of feeder-route transport aircraft. This design not only increases lift, but also provides more distance between the engine/propeller and the ground. This reduces possible damage to the engine due to dust and debris because feeder-route aircraft must have the capability to take off and land on dirt runways.

We boarded the "Y-7" through a rear entrance on the port side of the fuselage. The rear section of the fuselage contains the luggage compartment and the lavatory. The main passenger cabin has soft, cushioned seats arranged four to a row, with a 0.4 meter wide aisle in the middle. With 12 rows and 48 seats, the distance between rows is 0.78 meter; with 13 rows and 52 seats, the distance between rows is reduced to 0.72 meter. The aisle is carpeted. The distance from floor to ceiling is 1.86 meters. The passenger cabin and the cockpit are both pressurized and equipped with air-conditioning and pressurization systems which ensure proper temperature and pressure inside the cabin when flying at altitudes of 5000-6000 meters.

After we boarded the aircraft, the cabin door was shut, and this aircraft, designated model B-421, was ready to take us on a sightseeing tour over the nation's capital.

As the "Y-7" (with a maximum take-off weight of more than 21 tons) left the runway and started climbing at a speed of 180 kilometers per hour, the host invited us into the cockpit. The pilots who took part in this flight test were comrades

from the 8th Brigade of the Lanzhou Office of the Bureau of Civil Aviation. Pilots Zhang Yun and Cheng Yuanyong were awarded 1st degree citations for successfully performing the single-engine take-off and landing tests. Right now they were concentrating on piloting the aircraft on its upward climb. The sea-level climb rate of the "Y-7" is 7 meters per second; in only a few minutes we reached an altitude of 3,000 meters. Through the front and side windows in the cockpit we saw the green fields and sparkling rivers surrounding the capital. On top of the cockpit was an observation window. The engineer, the navigator, and the radio operator were also busy with their jobs. They were apparently excited about their mission to operate a Chinese-made aircraft. The cockpit was filled with an atmosphere of harmony. Our speed at this moment was approximately 480 kilometers per hour.

When this reporter returned to the passenger cabin, he saw the other passengers enjoying the aerial view through the side windows. Everyone was excited over being able to ride in a Chinese-made aircraft. Over the years during his travels at home or abroad, this reporter had been a passenger on more than ten different airplanes, but none of them were built in China. Although he had been in Chinese-made planes such as trainers, the "Zhi-5," the "Y-5," and Chinese-made gliders, they were not regular air transports. Riding in a Chinese-made airliner was indeed a new experience for him.

The "Y-7" is a feeder-route aircraft. The so-called feeder routes refer to civil transportation routes which range between 200 kilometers and 500 kilometers, and connect small to medium-sized cities. Since the 60's feeder-route aviation has increased rapidly in many countries; in particular, a number of Third World countries devoted special efforts to developing feeder-route transportation. Since the aircraft used on feeder routes are less expensive, more efficient, and require relatively simple airports to operate from, they are used extensively. But compared to the large turbofan jet passenger planes, the development of feeder-route aircraft has been rather slow. Most of the 50-seat aircraft currently being used belong to the first-generation feeder-route aircraft such as the Dutch F-27 "Friendship," the Canadian DHC-7, and the Soviet "AN-24." On the basis of technological standards, the "Y-7" is also considered a first-generation aircraft. At present, several countries are actively engaged in the development of second-generation aircraft which will have improved efficiency, lower noise level, and higher speed.

It is worth noting that certain countries such as Brazil and Indonesia are making a concerted effort to industrialize and to cultivate their aeronautical manufacturing capability; consequently, they are developing feeder-route aircraft either on their own or in cooperation with other countries, and in most cases they made significant progress. China is such a large country that it must be able to achieve independence in developing its own aeronautical industry. The successful development of the "Y-7" is a beginning in this direction.

Now the "Y-7" was gradually touching down on the runway. Under a take-off weight of 21 tons, the take-off distance is approximately 580 meters. The landing distance is approximately 500 meters.

After leaving the aircraft, this reporter arranged an interview with the chief of the flight technology team, Comrade Zhang Qinliang, who is responsible for all the technical aspects of the flight test. He had participated in both single-engine test flights, and has made significant contributions to the exploratory work involved in the test. He was awarded a first degree citation for his outstanding performance. Sitting on a sofa in one corner of the airport lounge, we began our conversation.

According to Zhang, because of China's vast territory, complicated terrain, and fluctuating climate conditions, a feeder-route transport must be able to operate under a wide range of geographic and weather conditions. The two 2,900-hp engines of the "Y-7" are designed to meet this requirement. But whether the actual performance meets design specifications must be verified through flight tests. Therefore, the flight test team had flown the airplane to every corner of the country. With the exception of Taiwan and Tibet, the "Y-7" has been to 28 different airports located at various provinces, cities, and autonomous regions. .It had been to northern airports with temperatures 30°C below zero, and to Wuhan, and southern Hunan airports with temperatures reaching 38.5°C. It had also flown to the hot and humid Nanjing'Shanghai region and to the Guelmo airport in the Gobi at 3,000 meters above sea level. Furthermore, it had been flight-tested on dirt runways at Hanzhong and Xianyang. These tests had demonstrated that the performance of "Y-7" can fully meet the requirements of its intended use.

When asked about the future of "Y-7" production, Zhang gave the following reply. Although the "Y-7" is designed primarily for feeder-route transportation of passengers and cargo, it can also be used for such missions as resouce exploration, aerial photography, air drops and rescue. Today, China's feeder-route aircraft are quite old and should be replaced, another need which can be met by this aircraft. Therefore, a significant number of orders for the "Y-7" are still required. Research and production departments will continue to make improvements and modifications to accommodate user needs. Obviously, as a member of the technical team, he fully acknowledged the responsibilities on his shoulders.

At this point, we all recalled the days back in the early 50's when we first entered the newly established Beijing Aeronautical Institute. The school had no lecture halls, no laboratories, and the students attended classes in a tent during winter. A posted sign on the campus which said, "Welcome, future aeronautical engineers!" was intended to boost the spirits of the students. Now, almost 30 years later, we are still traveling in foreign planes around the country. This is indeed quite disheartening.

After Liberation, the government and party strongly encouraged the development of the civil air transport industry in this country. As a result, significant progress was made, particularly after the 11th Central Committee Conference, when economic development improved the standard of living of the population and stimulated people's interest in travel. During the last 2 years, the total volume of civil transportation has been growing at an average rate of 21 percent annually. In 1981 the total volume reached 535 million ton-km, a 25-percent increase over 1980; it has become the fastest growing segment of the transportation industry (including railroads, highways, and waterways). Currently,

Chinese Civil Aviation has established more than 170 air routes with almost 600 flights per week, and more than 100 airports around the country (except Taiwan) are being used. Among the domestic air routes, 30-50-seat feeder-route aircraft account for more than 60 percent of the total number of flights, and carry approximately one-fifth of the total passenger-km volume of domestic travel.

According to statistics, China's volume of domestic air transportation currently ranks 15th in the world, on approximately the same as in England. If the current growth rate is sustained, at the end of this decade China will rank 7th or 8th in the world, and catch up with France. However, China is a large country with vast territory and a large population. The estimated capability of air transportation may not be able to meet the needs of projected socialist construction. At present, Chinese Civil Aviation has approximately 400 aircraft, of which over 100 are passenger planes with more than 30 seats. But in 1980 the passenger volume carried by air transports was only one-sixtieth of the total volume.

Compared to advanced nations in the world, China is also lagging behind by a wide margin. For example, in the United States, the number of feeder-route aircraft used in 1965 was 361; by 1980 it had increased to 1,333. In 1980 only one Chinese in 286 had traveled once by air, whereas in 1978 every American had traveled an average of 1.2 times by air. Currently, China's civil transportation is in a strained situation; increasing the transportation capacity of civil aviation undoubtedly will relieve the pressure on railroad and waterway transportation. In a large country such as ours, we must rely on ourselves to solve the problems of air transportation. For this reason, the future of domestic transport airplanes is very bright.

[Technical notes on the "Y-7"]
Wing span 29.25 meters, length 23.708 meters, height 8.56 meters, width of fuselage 2.9 meters, wing area 75 m^2; main wheel base 7.9 meters, front wheel base 7.9 meters; maximum take-off weight 21,000-22,000 kg, empty weight 14,235 kg, maximum payload 4,700 kg, cruising speed 480 km/hr, sea level climb rate greater than 7 meters per second, ceiling 8,750 meters, single-engine ceiling 3,400 meters, maximum fuel capacity 4,000 kg (4,800 kg with auxiliary fuel tank).

3012
CSO: 4008/8

GRAPHITE COMPOSITE MATERIAL TECHNOLOGY ON 'DAUPHIN' HELICOPTER STUDIED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 10, 5 Oct 82 pp 44-46

[Article by Li Ercheng [2621 3643 2052]]

[Text] During the past decade, the application of composite materials on aerospace structures has been advancing at an astonishing pace. At present, composite materials are used not only on many secondary components and the tail section of an aircraft, but also on certain important components and moving parts. The new materials, Kevlar, and graphite have been used on all sections of aircraft. On the "Dauphin" helicopter built by the French Aerospatiale Company, composite materials are used extensively; some of the applications, e.g., on the main rotor and the main blade housing, are quite unique and are representative of typical applications of composite materials on modern aircraft. The main purpose of this article is to describe the use of graphite on the "Dauphin" helicopter.

I. Application of Graphite Composite Material on "Dauphine" Helicopter

Since graphite is a material with high strength, high rigidity, and good fatigue characteristics (see Fig. 1) it is generally used on parts which have high strength requirement and are subject to alternating load conditions.

Specifically, graphite composite material is used on the following parts of the "Dauphin": the horizontal stabilizer, lateral vertical tails, suspension support arm, cargo floor, float, blade skin, blade housing support arm, variable torsion arm, vertical tail (and sheathing duct), transmission deck, and control mechanisms. The use of graphite composite materials reduces the weight of the "Dauphin" and lowers its cost (estimated to be one-half to one-third lower). It also improves its safety and fatigue characteristics.

The "Dauphin" helicopter allegedly uses more composite materials than other helicopters (see Fig. 2). At the end of 1979, the "Dauphin" N helicopter contained 25 percent composite material (another measure is that the ratio between composite parts and riveted parts is 87:13). By 1987, the percentage is expected to reach 30. The benefits of using graphite composite material on the "Dauphin" N are summarized in Table 1.

II. Types of Graphite Composite Materials

The graphite composite materials used on the structures of the "Dauphin" helicopter can be divided into two types (based on the temperature range of solidification):

1. solidification temperature of 180°C

1) V108, 45 percent, G827, thickness 0.2 mm, uni-directional fiber

2) V108, 48 percent, G803, thickness 0.2 mm, bi-directional fiber

2. solidification temperature of 120°C

1) M10, 45 percent, G827, thickness 0.2 mm, uni-directional fiber

2) M10, 45 percent, G803, thickness 0.3 mm, bi-directional fiber

3) M10, 45 percent, G814, thickness 0.25 mm, bi-directional fiber

4) TISSU, 145 2, 54 percent, G814

5) Kelvar, 145.2, 60 percent, 980

6) Fiberglass, 145.4, 50 percent, 664

7) HOMEX

Four different types of resin film and liquid glue are used:

180°C high temperature resin film, REDUX BSL319, used on the leading edge of vertical tail, stabilizer, and cover skin

120°C resin film, Marmco 1113.06, used on connections of reinforced ribs

120°C heat expansion glue, BSL212, used on connections between reinforced ribs and cover skin

120°c liquid glue, HYSOLE 9309, 3NA, can be used under normal temperature on metal joints

The graphite fiber cloth used in the production is a pre-soaked single-layered cloth covered with green plastic protective film and rolled into cylindrical shape. It is kept in a cold storage room with temperature maintained at -18°C. Therefore, for purpose of long-distance shipping, a liquid nitrogen low-temperature compartment would be required.

III. Shaping Procedure of Graphite Composite Material

1. Based on the characteristics of graphite fiber, various documents of production instruction, fabrication procedure, quality varification are available to the operator. A typical operating procedure is shown in Fig. 3.

2. Laying Material: The laying of graphite fiber cloth, which is covered with a protective layer, is generally done manually according to the dimensions of a blueprint or a template. In some cases it is placed directly on a mold and excess material is cut off with a thin blade. For parts produced in large quantities, a thin plate blast mold is used; for parts with multiple layers and complicated shapes, a numerically controlled laser device is sometimes used in order to meet the special requirements for cutting the fibers.

3. In the case of folded layers, the fibers must be laid strictly according to the order of the folds. To facilitate the process, the fibers are numbered sequentially.

4. Procedure for Shaping the Tail Sheathing Duct

1) The cover skin of the sheating duct consists of two (left and right) sections; the dimensions of each section are larger than 2m x 2m in length and width, with a hole in the center. There are two sets of shaping molds, which can be constructed from cast aluminum or from 4 mm aluminum plates with adjustable supports (see Fig. 5).

The graphite fiber cloth is first laid on the molding and sealed with plastic film; then it is evacuated to a vacuum of P = -0.8 bar, and heated in an oven until it is soldified.

2) The leading edge of the vertical tail (see Fig. 6) has a sandwiched honeycomb structure. Its shaping device consists of two halves of cast aluminum molding blocks. Inside the mold is an inflatable heat-resistant silicon-rubber bag. To facilitate operation the frame of the mold can be rotated or tilted. The rubber bag is inflated to a pressure of approximately 5 bar; and the oven is heated to a temperature of 180°C for about 1 hour.

3)The sheathing duct tube is made of graphite fiber cloth with a cylindrical sandwiched honeycomb structure (see Fig. 7). It is shaped using a cast-aluminum mold which is evacuated and heated to a temperature of 120°C to achieve solidification.

4) The plates and small parts of the vertical tail are straight and flat with reinforced strips in the middle. Generally they are shaped using a mold placed on a thermo press. The mold consists of a lower section and an upper cover plate and is stuffed with plastic blocks.

5) The tube axle is shaped by first molding graphite fiber cloth into a tube and four pairs of axle tiles (each tile is made from two halves), and then assembling the tiles and the tube. The shaping device consists of two halves of aluminum press mold and a heat-resistant rubber core rod. The tube axle must be subject to ultrasonic test and bending test. A diagram of the tube axle is shown in Fig. 8.

6) The assembly of various parts of the sheating duct is accomplished by glueing together the leading edge, the left and right cover skin, and the sheating duct tube. The assembly frame has the following features:

a) it is 3m long, 2.4m wide, and 1.7m high; it has a protable design for easy transportation.

b) it has the local surface positioning feature to ensure tight fit between glueing surfaces.

c) it has a tubular pressing device operated by a compressed-air system. The supply pressure is 6 bar.

d) the solidification temperature is 120°C.

IV Shaping Equipment

The equipment used for shaping graphite composite-material parts are as follows:

1) The thermo press (with heating platform) is 120-360 tons; its unit pressure can reach 10 bar, and the temperature is 200°C±2°C.

2) The oven is 5m long, 3m wide, and 2 m high. The interior wall has nozzles for evacuation; the maximum temperature is 200°C, and the temperature recording device has an error of ±2°C. The parts and components of the tail sheating duct are solidified using the oven rather then the thermo press.

3) The vacuum system and the compressed-air system used in the procedure are generally off-the-shelf equipment selected for each specific application.

4) To simplify the shaping process and to ensure the quality of adhesion, special-purpose silicon-rubber bags and blocks are used extensively. The blocks are heat-resistant and thermo-elastic; they are part of the molding equipment. The rubber bags in most cases are designed specially to conform with the shape of a particular product.

Figure 1. Comparison of Fatigue Strength of Different Materials

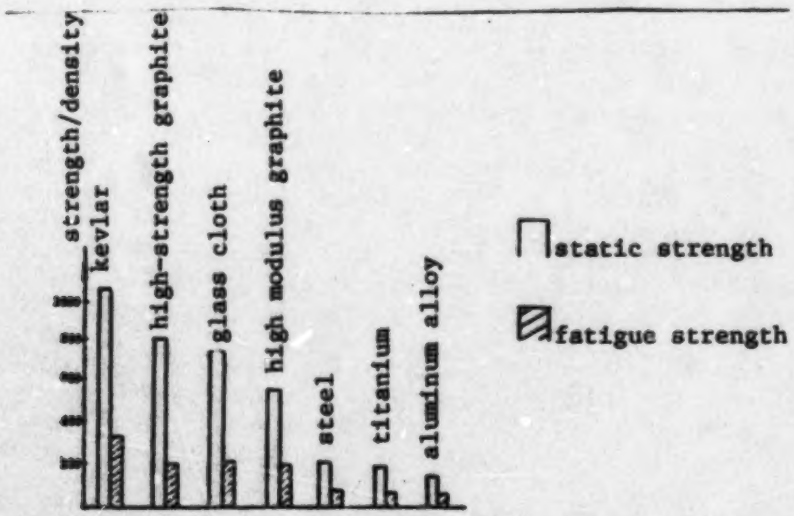


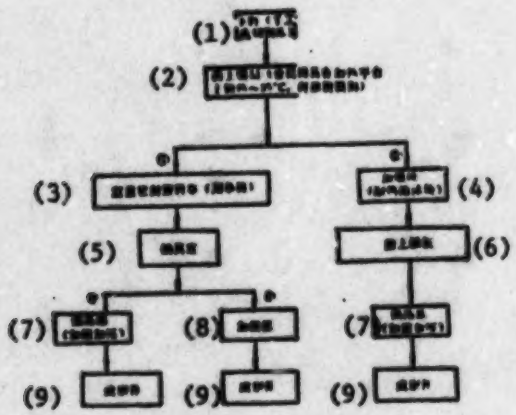
Figure 2. Distribution of Composite Materials on Dauphin Helicopter

Table 1.

Typical Benefits of Using Composite Materials

Part	Comparison with Metal Structure	
	Weight reduction	Cost reduction
Horizontal stabilizer and side vertical tail	30 percent	10 percent
Suspension support arm	45 percent	15 percent
Float	25 percent	50-60 percent
Blade housing support	0	—
Variable torsion arm	45 percent	20 percent
Vertical tail	15 percent	10-20 percent
Blade cover skin	0	—
Transmission and control mechanism	35-45 percent	—

Figure 3. Typical Operating Procedure



Key:

1. Laying material (manual or cutting bed)
2. Pre-heat metallic mold to 35°C on heating platform and add mold-removing coating
3. Cover with sealing plastic cloth (using single mold)
4. Add heat-resistant foam blocks
5. Evacuate
6. Cover with mold plate
7. Thermo press (heat and compress)
8. Oven
9. Shaped product

Figure 4. Simplified Diagram of Tail Sheathing Duct

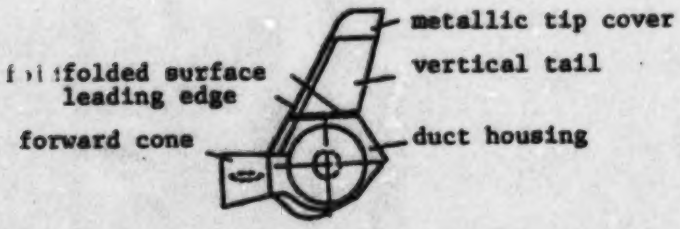


Figure 5. Shaping Mold for Sheathing Duct Cover Skin

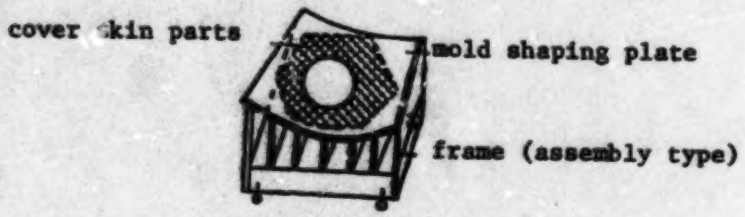


Figure 6. Shaping of the Leading Edge of Vertical Tail

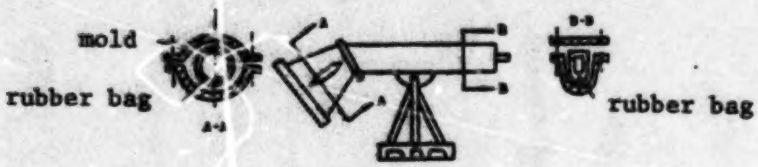


Figure 7. Sheathing Duct Cylindrical Part

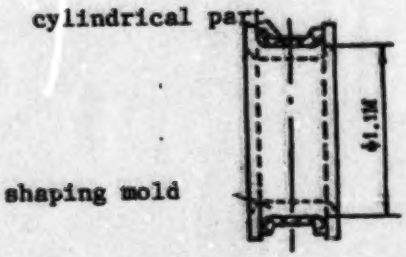
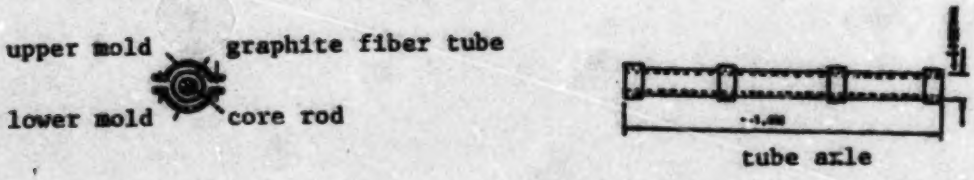


Figure 8. Tube Axle



3012
CSO: 4008/15

AUTHOR: GUO Wenming [6751 2429 2494]
CUI Zhensheng [1508 2182 5116]
NIE Xixian [5119 1585 6343]

ORG: All of Changchun Automobile Research Institute

TITLE: "A Fuel-saving Plan for Jiefang CA-10B and CA-10C Truck Engines"

SOURCE: Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 9, 25 Sep 82 pp 45-53

ABSTRACT: More than 900,000 Jiefang trucks have been manufactured throughout the years. It is the major type of car for highway and urban transport in China and the ones currently on the road will remain important for socialist construction in the future. They are, however, old and backward and consume a great deal of fuel. Under the current movement of advocating fuel conservation, aside from urgently preparing for model change, it is also necessary to improve the motive power property of the existing trucks to reduce fuel consumption. Following a great deal of research work on the CA-10B, and CA-10C engines of Jiefang trucks, the authors devised 5 plans to change the compression ratio of the aluminum cylinder head, to modify the intake and exhaust pipes, and to install the fuel-saving carburetor $231SB_1$, etc. Preliminary tests of these plans demonstrate definite fuel-saving results. Some of these new engine models, the economy model CA-10CJ, the CA-10CT, and the CA-10CG have been officially in production in 1982. The major structural parameters of the experimental cylinder heads, intake and exhaust pipes, and carburetors are reported and the test results discussed.

6248
CSO: 4009/30

AUTHOR: None

ORG: Machine Industry Automation Society, China Society of Mechanical Engineering

TITLE: "Automatic Production Line For Single Operation Forming of Ceramic Pipe Semi-hard Plastic Successfully Formulated and Certified"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 4, 1982 inside backcover

ABSTRACT: Under the guidance and concern of the municipal planning committee, economic committee, science committee, and the bureau of chemical engineering, and with the support of agencies such as the Northwest Academy of Construction Designing, the Mudanjiang Chemical and Ceramics Plant and the Mudanjiang Municipal Research Institute of Machines succeeded, after several years of research, in creating an automated production line for the single-operation forming of ceramic pipe semi-hard plastic. A certification conference was held in Mudanjiang City on 25-27 Aug this year to inspect the work process. This automated line is composed of 7 machines and a ZG-80 automatic control system. The line is capable of automatically pressing into form, automatically separating from the mold, and automatically cutting, repairing, turning, moving to another machine, etc. Judging from the observed condition of operation, this production line is a great improvement of the present hot and stuffy work environment of this product. The production line will greatly reduce labor intensity as well as improving production efficiency and product quality. The delegates of the conference believed that the successful formulation of the production line contributes to the automation of China's ceramic industry. The direction is definitely correct.

6168

CSO: 4009/33

AUTHOR: YU Fang [6735 2455]

ORG: None

TITLE: "Brief News"

SOURCE: Beijing WUZI GUANLI [MATERIALS MANAGEMENT] in Chinese No 10, 1982 p 24

ABSTRACT: A National Materials Departments Financial Management Work Conference was most recently held in Beijing. It was attended by 190 persons representing bureaus of materials of all provinces, cities, and autonomous regions, all units subordinate to the National Bureau of Materials, the Ministry of Finance, and the People's banks. The major task of the conference was to implement the spirit of this year's Conference of Heads of National Bureaus of Materials and the recently held National Financial Management Work of Enterprises Conference called by the Ministry of Finance, to improve material circulation economic benefits, to summarize the experience in material exchange and enterprise finance work, and to organize and reinforce the financial management of materials enterprises. During the conference, representatives of 10 units introduced their experiences. Comrade YU Xiaogu [0151 0876 6253] delivered the summarization speech and Comrade LUO Zhiqing [5012 1807 0615] delivered a report.

6168
CSO: 4009/40

AUTHOR: None

ORG: Gas Dynamic Laser Group, Institute of Mechanics, Chinese Academy of Sciences

TITLE: "Experimental Studies on a Gas Dynamic Laser with Narrow Throat and High Area-Ratio Grid Nozzles"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 5, 1982 pp 496-499

TEXT OF ENGLISH ABSTRACT: This paper describes a combustion-driven CO_2 gas dynamic laser with a throat height of 0.3 mm and an area-ratio of 30 grid nozzles, and presents some experimental results. The behavior of flow and the location of shock waves in the optical cavity were observed. The variation in small-signal gain G_0 with CO_2 or H_2O contents was measured and compared with the experimental data from similar equipment of nozzle throat height 0.8 mm and area-ratio 17. Some advantages are obvious for the narrower throat height and higher area-ratio GDL, i.e., the G_0 can be increased by a factor of 50 percent and the H_2O contents may be increased from 1 percent to 5 percent.

AUTHOR: SHEN Xiong [3088 3574]
LIAO Husheng [1675 3275 5116]

ORG: Both of the Department of Engineering Mechanics, Qinghua University

TITLE: "Measurements of Highly Turbulent Recirculating Flow by Applying a Frequency Shift LDV System"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 5, 1982 pp 505-511

TEXT OF ENGLISH ABSTRACT: This paper describes a LDV system with a frequency shift device in which two acousto-optic cells are used to produce the required frequency shift.

By applying this system, measurements of the highly turbulent recirculating flow in a plane, two-dimensional duct with a single-step expansion were carried out for Reynolds numbers from 2750 to 8250. Two data processing methods, one analogue method and the other digital, were employed in order to obtain the profiles of mean velocity and turbulent intensity. Velocity probability distribution and probability density functions are also displayed by the digital data processor.

The experiments show that measurements of various complex flows, such as highly turbulent, recirculating and oscillatory flow, can be realized with such a frequency shift LDV system.

9717
CSO: 4009/32

AUTHOR: CHEN Bingquan [7115 3521 5425]

ORG: Tongji University

TITLE: "On the Human Factor in Total Quality Control"

SOURCE: Beijing ZHILIANG GUANLI [QUALITY CONTROL] in Chinese No 5, 19[illegible]2 pp 11-12

ABSTRACT: In enterprise management, problems of quality control is often regarded as problems of technical management, to be responsible for by such technological experts as the chief engineer, engineers, etc. In reality, they are not purely technical problems. For example, 2 technicians of the same skill may not produce products of the same quality. This is to say that quality is not entirely determined by technical factors. A certain highly skillful technician of a certain plant suddenly produced unqualified products to cause the plant to lose several thousand yuan. When the reasons were analyzed, it was discovered that certain condition of the plant caused a depressed feeling about production and he was not able to concentrate on his work. This incident belongs to the human factor to be discussed in the paper. The paper introduces the functional equation of $Q = f(T \cdot R)$; where Q is the quality of products; T the technical level of workers; R the seriousness of the attitude of responsibility of the workers toward the quality of the products. The ways of improving this functional relationship are to pursue: (1) The benefit principle; (2) The principle of distribution according to labor contribution; (3) The principle of a system of responsibilities; (4) The principle of combining ideological education with material benefits. These principles are briefly expounded.

6168
CSO: 4009/39

AUTHOR: PEI Ronggang [5952 2837 6921]
QIAN Jin [6197 6651]

ORG: None

TITLE: "X-ray Residual Stress Test Technical Symposium Held in Handan City"

SOURCE: Shanghai WUSUN JIANCE [NONDESTRUCTIVE TESTING] in Chinese No 5, 1982 p 23

ABSTRACT: The Handan City Nondestructive Testing Instrument Plant was asked by the North China Group of the National Stress Test Technology Association to sponsor the X-ray Residual Stress Testing Technique Symposium. It was held in the afternoon of 5 May 82 in Handan City and attended by more than 70 specialists, engineers, and lecturers representing more than 50 research institutes, schools of higher education, and related factories. The symposium invited LI Jiabao [2621 1367 1405] of Shenyang Research Institute of Metals, Chinese Academy of Sciences, YANG Yuxing [2799 0060 5281] of Shanghai Jiaotong University, RAN Qifang [0373 0796 5364] of Zhengzhou Research Institute of the Ministry of Machine Industry, and ZHAO Hexiang [6392 6320 4382] of Handan City Nondestructive Testing Instrument Plant to serve as lecturers. The symposium lasted 15 days, during which time problems of application of x-ray residual stress testing technique in China's defense, research, and machine industries were discussed. Experiences in its applications were exchanged, and knowledge relating to the properties, applications, maintenance, and repair of stress testing instruments disseminated. The symposium has not only helped China's nondestructive testing technicians to understand and grasp the technology but also promoted the development of the technology in the country.
6168

CSO: 4009/37

AUTHOR: CHU Mingxiang [0443 6900 4382]

ORG: None

TITLE: "Brief News of Association Activity"

SOURCE: Beijing QIZHONG YUNSHU JIXIE [HOISTS AND CONVEYANCES] in Chinese No 9, 6 Sep 82 pp 36, 58

ABSTRACT: An Industrial Material Transport Technology Exchange Meeting was organized by the Hubei Provincial Material Transport Association on 22-25 May this year. It was held in Hubei Provincial Automobile Manufacturing Plant No 2, and Wuhan College of Water Transport Engineering was in charge of arranging the meeting and the Automobile Manufacturing Plant No 2 took care of its preparation. The participants included 30+ delegates representing industries, schools of higher education, and designing and management agencies within the province. Additionally, the National Material Transport Association also sent representatives. Discussions at the meeting include: (1) The work condition of caternary suspension on the car assembly line; (2) Preliminary application result, long range prospect, and the economic benefit of multi-story parts warehouse center for supplying more than 570 types of parts of the car assembly line at the Automobile Manufacturing Plant No 2; (3) Condition of material transport system in Automobile Manufacturing Plant No 2 and suggestions for its improvement and reconstruction. During the meeting, the delegates visited the Central Test Laboratory of the 7 branch-factories of assembly, body shop, engine shop, etc. The delegates saw that most parts no longer touch the floor in the machining process. By observing the practice at the plant, they understood more than ever the importance of scientific transport methods in preserving the quality of parts, reducing cost of products, and improving labor productivity in manufacturing industries.

6248
CSO: 4009/31

END

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4 January 1983

China Report

SCIENCE AND TECHNOLOGY

No. 183

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No. 183

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APPLIED SCIENCES

BRIEFS

ACCURATE STANDARDS OF LENGTH--Beijing, 8 Nov (XINHUA)--China's standard meter and the standard meter in terms of laser wavelength now rank among the most accurate in the world, the State Administration of Standards announced here today. According to data published by the International Advisory Committee on the definition of the meter, comparisons during the past few years show China's standard meter is accurate to 0.02 microns of the international prototype meter kept in Paris, ranking best among Australia, Canada, Britain, Japan, the United States, the Democratic Republic of Germany, the Soviet Union, and Italy, and other countries that took part in the international comparisons. The laser wavelength China uses to reprouce standards of length is also among the most accurate of these countries, the administration said. The wavelength is derived from the constant frequency laser of methane gas. Based on this wavelength, which is far more accurate than the isotope laser wavelength, China has established a length measuring system widely applied in production, scientific research and national defense. [Text] [Beijing XINHUA in English 0806 GMT 8 Nov 82]

CSO: 4010/23

AUTHOR: LIU Limin [0491 4409 3046]

ORG: Tianjin Research Institute of Construction Machinery

TITLE: "Condition of Experiments in Construction Machinery Under the Plateau Low Temperature Condition in China and Several Suggestions"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 11, Nov 82 pp 2-8

ABSTRACT: In China, research on the manufacture of plateau low temperature type construction machinery began in the middle of the 60's to meet the requirements of Qinghai-Xizang Plateau where the elavation is high, the air thin, the temperature low, the solar radiation intense, the wind and sand storms great, the weather arid and there are large areas of permafrost zones. Based upon experimental reports of related systems of the Ministry of Machine Industry on such construction machines as trucks and their components made by these systems to operate under such an adverse environment, the paper introduces briefly the power recovery and adaptability of several diesel engines, the weather protective property of the driver's cab, the low temperature resistance of rubber parts, the low temperature lubricants, and the low temperature adaptability of the entire truck. The work of research on plateau low temperature machines has barely begun. The author suggests that in the future there should be work on classification of plateaus and low temperature conditions, on the key technical problems of the engine and its clutch, the hydraulic transmission system, low temperature brittleness resistant metals, such work processes as

[continuation of GONGCHENG JIXIE No 11, 1982 pp 2-8]

heat treatment, casting, and welding, low temperature resistant rubber and lubricants, etc. Furthermore, the author believes that China should prepare to develop techniques and machinery for excavating frozen earth and to establish low temperature and low pressure laboratories.

6168

CSO: 4009/45

AUTHOR: SU Enyi [5685 1869 0001]

ORG: None

TITLE: "Brief News of the Symposium on Export and Industrial Technology of Light and Small Conveyors"

SOURCE: Beijing QIZHONG YUNSHU JIXIE [HOISTS AND CONVEYANCES] in Chinese No 10, 6 Oct 82 p 60

ABSTRACT: On 10-14 Jun 82, a Symposium on Export and Industrial Technology of Light and Small Conveyors was called in Wuxi, Jiangsu Province under the auspices of the Bureau of Heavy Mining Machinery of the Ministry of Machine Industry. Participants included 40 delegates representing 6 major light small conveyors manufacturing plants and 16 other research institutes and related provincial and municipal bureaus of machines. The Research Institute of Hoists and Conveyances was asked to report on the current domestic condition of production of such machines, their export requirements, and types and quality improvements needed to expand their export trade. This report was followed by analyses of some problems of quality, including the poor abrasion resistance of the wheels, the small capacity of the batteries, the short useful life, the unsatisfactory DC motor, oil leakage of the hydraulic system, the unreasonable design of the section of the frame, etc. The Bureau of Heavy Mining Machinery required these problems to be resolved during the year of 1982-83 and gave the Research Institute of Hoists and Conveyances the responsibility of formulating breakthrough plans and supervising the work and inspecting the results of resolving these problems.

6248
CSO: 4009/41

AUTHOR: None

ORG: Standardization Office, Dalian Research Institute of Diesel Locomotives

TITLE: "Conference of Examination of Standards for Diesel Locomotives Held in Dalian"

SOURCE: Dalian NEIRAN JICHE [DIESEL LOCOMOTIVE] in Chinese No 9, 15 Sep 82 p 22

ABSTRACT: The Conference of Examination of Standards for Diesel Locomotives, jointly sponsored by the Bureau of Science and Technology and the Bureau of Industry of Ministry of Railways was held in Dalian Locomotive and Car Plant, on 10-16 Aug. Participants included 71 delegates representing 31 related bureaus, plants, academies, and institutes; 6 specialists and professors of the field of diesel locomotives were also invited to attend. Detailed discussions were carried out concerning the adoption of equivalent standards of the UIC in their entirety. This was the first time the Ministry of Railways stated its plan of directly adopting the international standards. All present agreed that conditions must be urgently created for the adoption of the UIC standards. The delegates carefully checked, word for word and sentence for sentence, the UIC document translated into Chinese from the German, French, and English originals. The contents were analysed and discussed in an effort to understand the original meanings fully. The 2 important Ministerial standards on the technical condition of the gudgeon [piston] pin of the diesel engine of the internal combustion locomotive (including the metallic phase spectrum) and the general technical condition of the governor system of the diesel engine were also examined and passed at the conference.

AUTHOR: GUO Yunlin [6751 5366 5376]

ORG: Dalian Research Institute of Diesel Locomotives

TITLE: "Experience Exchange Conference of Applications of Electronic Computer in the Designing Research on Locomotives Held in Dalian"

SOURCE: Dalian NEIRAN JICHE [DIESEL LOCOMOTIVE] in Chinese No 9,15 Sep 82 pp 61,60

ABSTRACT: The Bureau of Industry of Ministry of Railways called the Experience Exchange Conference of Applications of Electronic Computer in the Designing Research on locomotives on 13-20 Aug 82 in Dalian, to be jointly sponsored by the Dalian Research Institute of Diesel Locomotives and Dalian Locomotive and Car Plant. Participants included 45 delegates representing 11 bureaus and plants. The conference received 45 papers. Dalian College of Engineering Prof ZHONG Wanxie [6945 8001 0533] reported on the development and current condition of software applications and YANG Mingsheng [2799 2494 3932] introduced the DDJT graphic program. A class for learning the DDJT Program was launched on 18-20. These activities and some suggestions presented at the conference are briefly reported.

6248
CSO: 4009/34

AUTHOR: None

ORG: None

TITLE: "Symposium on the Special Subject of 'Earthquake Resistant Property of Multi-storied Brick Masonry Structure and Its Safety Evaluation' "Held in Hangzhou"

SOURCE: Harbin DIZHEN GONGCHENG YU GONGCHENG ZHENDONG [EARTHQUAKE ENGINEERING AND ENGINEERING VIBRATION] in Chinese Vol 2 No 3, Sep 82 p 106

ABSTRACT: The Research Institute of Engineering Mechanics Chinese Academy of Sciences, entrusted by the Earthquake Resistance Office of the National Construction Committee, held the Symposium in Hangzhou on 27 Mar to 2 Apr 82. Participants included 49 delegates representing 26 departments of scientific research, schools of higher education, and earthquake resistance administration. The symposium received 43 papers, covering (1) Basic research on earthquake resistance property of brick and masonry structures; (2) Earthquake resistance evaluation of multi-storied brick buildings and research on the method of forecasting earthquake damage; (3) Evaluation of earthquake resistance of multi-storied brick buildings and the application of the method of forecasting earthquake damage; (4) others. Brick structure remains the current and future major form of structures in China. The experience of damages during several earthquakes in the past has attracted a great deal of attention to the study of its earthquake resistance property. The method of forecasting earthquake damage to multi-storied brick buildings was extensively discussed at the symposium. Through extensive statistical analysis of earthquake damages and combined

[continuation of DIZHEN GONGCHENG YU GONGCHENG ZHENDONG Vol 2 No 3, 82 p 106]

with the existing regulations on earthquake resistance designing, the method is based upon the building as an entity, yet using the earthquake resistance of the walls as the major criterion. At the same time, effects of the conditions of the site, the favorable and unfavorable factors of the various parts of a structure are also taken into consideration. This method was used by the Research Institute of Engineering Mechanics and Henan Provincial Office of Earthquake Resistance to make damage forecasts in Anyang and N. Henan and by the Liaoning Research Institute of Construction for 3 cities of S. Liaoning. The delegates offered many valuable suggestions with respect to perfecting and applying this method. A symposium on the special subject of problems of the inner framework structure was proposed for the future.

6248
CSO: 4009/43

AUTHOR: FENG Qichao [7458 6386 6389]

ORG: None

TITLE: "Standardization Work Conference of the Mining Machinery Industry Held in Datong"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 10, Oct 82 p 64

ABSTRACT: The adoption of the international standard is an important decision of stategic significance for promoting the machine industries. In order to implement the spirit of this decision of the Ministry, the Bureau of Heavy Mining Machinery of the Ministry called the work conference in the middle of Aug 82. Following discussions on the necessity and importance of adopting the international standard, the formula of standardization work in 83-85 and the standardization work plan for 83 are preliminarily proposed. The form, timing, and place of the items to be revised were determined to finalize the standardization work arrangement for the future. During the conference, the Luoyang Mining Machinery Center and the Shenyang Mining Machinery Center introduced the conditions of comparison between the Chinese and foreign standards of pit hoist machines, crushers, windlasses, and ore dressing machines. The conference proposed: (1) The industry must be determined to adopt the international standard; (2) If any current standard indices in China are higher than the international indices, they should not be reduced unless they are truly unreasonable; (3) Comprehensive technical properties must be adopted in their entirety in the standard; (4) Standards must be nationally uniform; (5) As much as possible all equivalent standards should be revised into national standards.

AUTHOR: None

ORG: Editorial Department of HUAGONG KUANGSHAN JISHU

TITLE: "1983 Subscription to HUAGONG KUANGSHAN JISHU Invited"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 10, Oct 82 p 64

ABSTRACT: HUAGONG KUANGSHAN JISHU is a journal of mining technology of a nationwide characteristic, just been approved for publication by the Ministry of Chemical Engineering Industry, mainly for reporting research results and experience in mining chemical engineering, announcing national goals and technical policies of mining development, introducing new domestric and foreign achievements and advancements in mining work processes, equipment, theories, etc. The contents of specialization will include mining geology and surveying, pit and tunnel construction, open and underground mining, mining machinery and electricity, ore dressing processes and agents, technical economics and enterprise management, comprehensive utilization ore chemistry, mining safety, environmental protection, etc. The journal will be available for subscription at the post offices everywhere in the country. Readers may also remit money directly to the Ministry of Chemical Industry for its subscription.

6248
CSO: 4009/44

AUTHOR: None

ORG: None

TITLE: "Meeting for Establishing the Thermal Material Metrology Specialty Committee and Its First Scientific Symposium Held in Chengdu"

SOURCE: Beijing JILIANG XUEBAO [ACTA METROLOGICA SINICA] in Chinese No 4, 22 Oct 82 p 329

ABSTRACT: For the purpose of raising the level of testing hot materials and media, the Chinese Metrology Society Thermal Material Specialty Committee was established in Chengdu City on 2[illegible] May 82. The meeting was attended by 98 delegates representing 62 organizations. The application of thermal materials in the national economy, its relationship with other sciences, and its problems urgently requiring solutions were discussed and many valuable suggestions proposed. During the scientific symposium held at the same time, the 63 submitted papers and technical reports were discussed. They involved metallic, inorganic nonmetallic, organic high molecular materials and food grains. The physical properties for testing included heat conductivity, temperature conductivity, specific heat, emission rate, expansion coefficient, and such related parameters as resistance, density, modulus of elasticity, etc. Scientific democracy prevailed and discussions proceeded very lively to forebode a prosperous future for this field in China.

6248
CSO: 4009/42

AUTHOR: RONG Chuan [1369 1557]

ORG: None

TITLE: "First Conference of the Tunnel and Underground Engineering Branch of the Volume on Civil Engineering· Chinese Encyclopedia"

SOURCE: Chongqing DIXIA GONGCHENG [UNDERGOUND ENGINEERING] in Chinese No 9, 11 Sep 82 pp 45, backcover

ABSTRACT: The first conference of the Tunnel and Underground Engineering Branch of the Volume of Civil Engineering·Chinese Encyclopedia, held in Wuxi City on 10-17 Apr 82 was organized by the Science and Technology Department of the Encyclopedia Publications, the Railway Engineering Department of Southwest Jiaotong University, and the Underground Engineering Department of Tongji University and attended by 15 delegates representing 9 organizations. Prof ZHANG Qingwen [1728 1987 2429] chief editor of the Volume on Civil Engineering of the Encyclopedia delivered a detailed introduction of the meaning, goal, characteristics, and editorial policy and style of the Encyclopedia. Assistant Prof PAN Changqian [3382 2490 0051] of Tongji University and Assistant Prof FAN Wentian [5400 2429 3944] of Southwest Jiaotong University explained the draft headings of the branch under discussion and the revisions proposed by the various organizations. On these bases, the delegates carried out a spirited discussion on the headings of this branch and agreed on a preliminary framework of headings of this branch, their contents, and the number of words involved.

[continuation of DIXIA GONGCHENG No 9, 1982 pp 45, backcover]

The list of persons to be invited to write the articles were recommended. The first edition of Chinese Encyclopedia is to be published in separate volumes to number a total of about 70 volumes. In the volume on Civil Engineering, there will be 17 branches. Following negotiations, it was finally resolved that the Tunnel and Underground Engineering Branch will be divided into tunnels and underground engineering, tunnels, railway tunnels, highway tunnels, navigation tunnels, hydrological engineering caverns, under water tunnels, Huangpujiang Tunnel, Municipal Tunnels, underground railways, Beijing Subway, underground engineering, civil defense engineering, International Tunnel Association, Chinese Civil Engineering Society Tunnel Society, tunnel and underground engineering support structures, classification of surrounding rocks, etc.totaling 53 items in about 100,000 words [characters.] The preliminary writing and editing work is to be finished by the end of this year to preceed with revision, etc. in 1983.

AUTHOR: XU Shuigen [1776 3055 2704]

ORG: None

TITLE: "Treatment of Water Leakage in Underground Buildings"

SOURCE: Chongqing DIXIA GONGCHENG [UNDERGROUND ENGINEERING] in Chinese No 10, 11 Oct 82 pp 32-35

ABSTRACT: The designing of ventilation and dehumidification of undergound buildings concerns normally only the moisture dispersed from the building walls and the humidity brought in by persons and air. But, if serious water leakage is present, the moisture dispersion may double. The larger is the area of leakage, the greater is the moisture dispersed within the building. Water leakage of underground building is usually caused by expansion and contraction seams, construction seams, and fractures of the concrete, and defects of the cement. Methods and available materials for treating these 4 situations of water leakage in an underground building are explained separately in the paper, including the technique of mixing water repellent materials such as epoxy resin, polyamide plastics, tar, etc.

AUTHOR: YUAN Guosheng [5913 0948 0524]
LU Weicheng [7120 0251 2052]

ORG: None

TITLE: "Example of Large Span Tunneling Method in Loose Geological Conditions"

SOURCE: Chongqing DIXIA GONGCHENG [UNDERGROUND ENGINEERING] in Chinese No 10, 11 Oct 82 pp 37-41

ABSTRACT: A certain underground structure is composed of a passageway, the main caverns, and corridors linking the caverns, A main cavern has a net span of 24.1 m and a net height of 21.5m. The structure is in a region of sedimentary and metamorphic rocks, with relatively complex geological conditions. A regional fault passes the entrance and the tail end of the structure. In the middle, there is a soft and weak stratum of phyllites, intersecting the axis line of the cavern at 70-85°. The structure was completed in 1972. The phyllite section was provided with temporary support of a wood framework for the arch. By the end of 1974, peeling type defects occurred. Excavation disclosed cave-in at a height of 26 m. Of the 3 possible methods of (1) Enlarging the base of the arch; (2) Installing anchor holes; (3) Installing beams in the corners of the arch, the 3rd method was adopted to resolve the problem of stability of the arch and to reduce the danger of uneven settling of the walls to the arch. This and other secondary measures adopted to repair the structure are explained in considerable detail.

6248
CSO: 4009/38

END

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China Report

SCIENCE AND TECHNOLOGY

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21 January 1983

CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 184

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FEATURES OF NUCLEAR SUBMARINES OUTLINED

Beijing HE DONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese No 3, Aug 81 pp 95-96

[Article by Shi Lei [4258 4320]]

[Text] A modern missile-carrying nuclear submarine can travel at a speed of 30-40 knots, which exceeds the speed of many surface ships. It can engage in sea combat at a depth of 400 meters, which is eight times the capability of early submarines. It can survive for several years without refueling; and its range and endurance are almost unlimited. Its cruising period is primarily determined by the physiological conditions of the crew members and considerations of supplies and maintenance. A nuclear submarine can carry 10-20 missiles; if the range of missile is approximately 5000 km, then an ocean-borne nuclear submarine can deliver missiles to essentially any location of an enemy territory. By utilizing the ocean as a natural cover and by taking advantage of its underwater mobility, a submarine can easily avoid damage during a nuclear first strike. Thereofre, most powerful naval nations use nuclear-missile submarines as strategic weapons to ensure second strike capability and nuclear retaliation.

The strategic value of a nuclear submarine is attributed to its unique characteristics. The "heart" of the submarine is its nuclear power plant, which generates enormous amounts of energy to propel the submarine rapidly through the ocean. It can travel either on the surface or submerged; it does not burn coal, nor does it require petroleum or air. Its fuel is a metal--uranium, commonly referred to as nuclear fuel. The amount of energy released by "burning" 1 kg of U-235 nuclear fuel is equivalent to that from burning 2,000 tons of coal. Since oxygen is not required for combustion, a nuclear submarine can remain submerged for long periods. Furthermore, because of the small amount of fuel required, a nuclear submarine can travel a long distance (several times around the globe) after one refueling. This type of nuclear power plant is generally composed of two separate closed-loop circuits, as shown in the illustration. The primary circuit contains the reactor, pressure stabilizer, a steam generator, and a circulating pump. The secondary circuit contains a steam turbine, a condenser, and a condensed water pump.

The reactor contains a large amount of nuclear fuel which is usually shaped in the form of pellets and packed in slim metal tubes called fuel rods. The chain

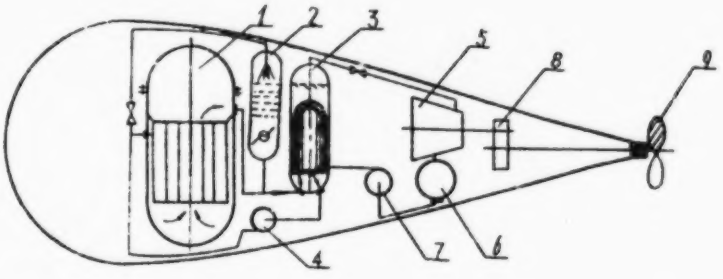
reactions of neutrons cause fission in the nuclear fuel U-235, and at the same time release large amounts of energy. This energy is generally released in the form of heat, causing the temperature of the nuclear fuel to rise; the heat is transferred through the surface of the fuel rods and carried away by the high-temperature, high-pressure, rapidly circulating coolant (water) which circulates in the primary reactor circuit. Carrying heat energy from the reactor, the coolant enters the steam generator, which is generally composed of a bank of tubes through which circulates the high-pressure, high-temperature water of the primary circuit. Outside the tubes flows a mixture of steam and water circulating in the secondary circuit. In this manner, heat energy is continuously being transferred from the primary circuit to the secondary circuit, and the water there is continuously being converted into steam. After leaving the steam generator, the water in the primary circuit passes through a circulating pump, and returns to the reactor to further absorb heat energy released from nuclear fission. The heat is again transferred to the steam generator where water from the secondary circuit is vaporized. By repeated circulation of the water in the primary circuit, the process of continuous heat transfer is accomplished.

The water in the secondary circuit continuously absorbs heat through the steam generator and continuously evaporates into steam. By passing through a phase separator, the "dry" steam flows into the steam turbine, where its heat energy is converted into mechanical (rotational) energy. The rotational energy of the turbine is transmitted to the main axle of the submarine through a speed reduction gear box, thereby turning the propeller and pushing the submarine forward. A power plant such as this can also be used to propel other vessels.

To ensure safe operation, the pressure of the reactor must be maintained at a stable level; i.e., the pressure fluctuations must be very small. To maintain pressure stability in the primary circuit a pressure stabilizer is generally installed where the primary circuit exits from the reactor. The stabilizer is a high-pressure container whose lower part has an electric heating element and is filled with water; the upper part is filled with steam and is equipped with a spray nozzle. If for some reason the submarine is suddenly commanded to accelerate, the steam consumption in the turbine will suddenly increase and the temperature in the secondary circuit will decrease. This sudden demand is transmitted through the steam generator and causes the temperature and pressure in the primary circuit to drop. This change in temperature and pressure is sensed by the automatic control system which activates the electric heating element in the pressure stabilizer. As a result, more water is evaporated and the pressure is restored in the container. Similarly, if the speed of the submarine is reduced, the load on the turbine is decreased, and the pressure in the primary circuit will rise. The automatic control system will then activate the spray nozzle to spray the comparatively low-temperature water from the entrance to the reactor onto the steam which occupies the upper part of the pressure stabilizer. This causes part of the steam to condense and lowers the pressure in the primary circuit. In this manner, the pressure in the reactor can be maintained at a constant level, and the submarine can maneuver safely in the vast ocean in response to human commands.

It is clear from the simple description of the operation of nuclear submarine that it does not require frequent refueling, nor does it require a separate fuel tank; the several hundred kilograms of nuclear fuel are stored in the reactor. Also, since the nuclear power plant can operate without oxygen, the nuclear submarine not only can remain submerged for a long period, but also has considerable capacity to allow additional payload and space for installing weapons and for improving the living conditions of crew members. Consequently, the superior characteristics of the nuclear-powered submarine cannot be matched by conventional submarines.

In addition to the several hundred nuclear submarines currently in existence around the world, nuclear power plants have been installed in other vessels; these also have demonstrated the incomparable superiority of nuclear power. For example, they have been used on nuclear aircraft carriers such as the U.S. "Enterprise," the "Nimitz," the "Eisenhower," and the "Vinson"; the Soviet Union is also building a 50,000-ton class nuclear aircraft carrier. Nuclear power plants are also used on ocean cruisers. The famous Soviet icebreaker "Lenin" is also powered by a similar nuclear power plant. The nuclear merchant ship "Otto Hahn" built by West Germany has traveled over 640,000 nautical miles. Japan has not only built the nuclear-powered ship "Mutsu," but has also proposed designs of nuclear-powered underwater oil tankers. On the basis of the current trend of development, we firmly beleive that the application of nuclear power in oceanic transportation has a bright future. It is not inconceivable to imagine that some day a nuclear-powered underwater ocean liner may be developed; at that time, travelers not only can cross the Pacific or the Atlantic in total calmness, but also will be able to enjoy the fascinating scenery at the bottom of the ocean.



Schematic Diagram Showing the Propulsion System of a Nuclear Submarine

1. reactor;
2. pressure stabilizer;
3. steam generator;
4. circulating pump;
5. steam turbine;
6. condenser;
7. condensed water pump;
8. speed reduction gear box;
9. propeller

3012
CSO: 8111/1074

NATION COMPLETES ITS FIRST LARGE-SCALE SOLAR OBSERVATORY

Beijing RENMIN RIBAO in Chinese 22 Dec 82 p 4

[Text] China's first large-scale solar observatory has recently been completed at the Purple Mountain Observatory in Nanjing. This big observatory is among the 20 or so largest such observatories in the world today. All major targets have been determined by experts to have met or surpassed design specifications.

The sun-tracking telescope at the top of the observatory.

Exterior view of China's first solar observatory

CSO: 4008/36

PRC DEVELOPS NUCLEAR ENERGY FOR PEACEFUL USES

OW271301 Beijing XINHUA in English 1137 GMT 27 Dec 82

[Text] Beijing, 27 Dec (XINHUA)--China is developing atomic energy in the service of the national economy and people's livelihood, according to a spokesman for the Ministry of Nuclear Industry.

The spokesman predicted today that nuclear power will become an important source of energy, especially for areas short of coal, oil or water power.

The two nuclear power stations planned to be built in Zhejiang and Guangdong Provinces will usher in a new age in the peaceful use of nuclear power and technology, he said, and more such installations are being considered for other energy-short areas.

Production of radioactive isotopes is another major aspect in the peaceful use of nuclear power and technology. The spokesman revealed that China now has several reactors producing radioactive isotopes. These reactors owned by the Ministry of Nuclear Industry alone are producing more than 230 kinds of isotopes for more than 1,200 users throughout the country. In addition, there are more than 100 nuclear irradiators installed in all provinces, municipalities and autonomous regions except Tibet, he said.

Isotope technology is now applied in many fields, including agriculture, industry, medical treatment, physics, chemistry, biology, geology, archaeology and environmental protection.

The spokesman said that, using irradiation or combined methods, Chinese agronomists have succeeded in developing 150 high-yielding crop strains.

"Yuanfeng Zao," a rice strain developed by the Zhejiang Academy of Agricultural Sciences through irradiation, ripens 45 days earlier than the original strain and yields ten percent more than other varieties of the same growth period.

"Lumian No 1," a new cotton variety also developed through irradiation by the Shandong Provincial Cotton Research Institute, had been planted on two million hectares up to 1981 and yielded an extra 450,000 tons.

Nuclear medicine research is also developing in China. More than 700 hospitals are using radioactive isotopes to diagnose and treat diseases. The accuracy rate for diagnosing thyroid hyperfunctioning by isotope technology is reported to be as high as 85 to 95 percent.

A liver cancer survey by the serum alpha fetoprotein radioactive immune assay among 180,000 people in a high-incidence area accurately found 300 cases, 134 of which were at an early stage of the disease, where no symptoms are apparent.

Nuclear medical methods are used in theoretical research in biochemistry, pharmacology, genetics and fundamentals of acupuncture anaesthesia, enriching the theory of Chinese traditional medicine.

Gamma rays and neutrons are used to measure the depth of wells and search for underground water.

Positive results have also been reported in using nuclear radiation to test meters for industrial automatic control and measurement, the ministry spokesman said.

CSO: 4010/31

PRC DEVELOPS AUTOMATIC QUAKE OBSERVATION SYSTEM

OW230810 Beijing XINHUA in English 0758 GMT 23 Dec 82

[Text] Shanghai, 23 Dec (XINHUA)--China's first automatic seismological observation and data processing system for telemetric seismological networks went into operation here today.

The system was appraised at a six-day meeting, which closed here today, organized by the State Seismological Bureau. Experts and engineers present said that the concept and the design requirements for logic and functions of the system meet advanced standards.

The system is the basic part of the telemetric seismological regional networks that China is establishing separately in Shanghai, Beijing, Kunming, Chengdu, Lanzhou and Shenyang. The Shanghai network has performed well during a trial run of more than a year, the meeting said. The other five networks are being developed.

Each telemetric seismological network is composed of an earthquake-monitoring system, a quake-indicator observing system, a data telegraphing and telemetering system, a data-processing and storage system, a time-regulating system and power supply.

The quake-monitoring system of each network is equipped with surface and deep-well observing seismographs with magnifying power ranging from one to hundreds of thousands and the frequency ranging from 0.005 Hertz to 20 Hertz. The system can pool, record and process 117 routes of seismic signals.

Within a short time after the occurrence of a strong earthquake in China or abroad and the seismic wave has reached the observation stations, the system can quite accurately determine the basic parameters of the quake and take complete notes, the meeting said.

The quake-indicator observing system can periodically produce controlling signals to start and stop the operation of meters and instruments at the field observation stations, which can automatically observe and telemeter various geophysical and geochemical signals concerning earthquakes. The signals include the changes of the intensity of geo-magnetic field, the apparent earth resistivity, the content of radon in underground water, the crustal stress, the

faulting of the land, air temperature, atmospheric pressure, waterfalls and others. At most, the system can collect, telemeter, arrange and process 1,200 signals from 40 field stations, the meeting reported.

The data gained by the field stations can be quickly telegraphed or telemetered to the regional network center. The data processing system equipped at the center includes computers, seismic triggers, map-marking instruments and other equipment. The center can quickly process and store in different forms large amounts of data.

A high-precision digital clock station and a coding remotesensing regulation device at each center can provide a time standard for the whole system and undertakes automatically regulating time for all its field observation stations.

Most of the equipment of the system including computers were designed and made by China. The software, namely the special-purpose computer programs, was all developed and readjusted by Chinese technicians.

CSO: 4010/31

BRIEFS

PROTON LINEAR ACCELERATOR OPERATIONAL--Beijing, 21 Dec (XINHUA)--The High Energy Physics Institute under the Chinese Academy of Sciences recently completed construction of a 10 million electron volt proton linear accelerator in the western suburbs of Beijing, the biggest of its kind in China so far, according to Xie Jialin, deputy director of the institute. The accelerator was initially adjusted and began producing a beam of protons at 0300 on 17 December. The energy of the beam was 10 million electron volts and its intensity was 14 miliamperes. Readjusting work is now going on to further raise the intensity of the beam. The completion of the accelerator was a breakthrough in China's development of accelerators, Deputy Director Xie Jialin said. [Text] [OW221309 Beijing XINHUA in English 1143 GMT 21 Dec 82]

DEEP SEABED SPECIMENS--Beijing, 10 Dec (XINHUA)--China has for the first time collected biological and mineral specimens from a 5,137-meter deep seabed. The Stat Oceanography Bureau said that the collection of the specimens is another major advancement in developing the technology of deep-sea surveying. The "Xiangyanghong No 16," a new 4,000-ton survey ship of the East Sea Branch of the National Bureau of Oceanography, collected the specimens in its trial voyage in northwest Pacific Ocean, where the water is more than 5,000 meters deep. China's previous record in collecting deep-sea specimens was 3,949 meters. Using a domestic-made hydraulic winch with a 13,700-meter-long steel cable drawing a benthonic trawl, the ship collected lapilluses, a fragment of lava, which fell into the sea billions of years ago, and nodular ore bodies as well as varieties of benthonic specimens from the sea floor. The ship also collected surface and columnar geological materials from the bottom of the sea by using a geological winch with a 6,000-meter-long steel cable. These specimens and materials are now being identified, the bureau said. [Text] [OW221309 Beijing XINHUA in English 0243 GMT 10 Dec 82]

NEW MINERAL DISCOVERY--Beijing, 10 Dec (XINHUA)--A new mineral xitieshanite, hydroxyl-bearing ferro sulphate, has been discovered by Li Xilin of the Institute of Geochemistry under the Chinese Academy of Sciences, in cooperation with Zhou Jingliang and Li Jiaju of the Institute of Geology. The mineral lies in the oxidation zone of the lead-zinc deposits in Xitieshan, Qinghai Province. The mineral, semi-transparent to transparent, is light green to lemon yellow with yellow streaks and vitreous lustre. On 19 August, Dr Akira Kato, chairman of the Commission on New Minerals and Mineral Names under the International Mineralogical Association, officially informed scientist Li Xinlin that the

commission recognized xitieshanite as a new mineral. Chinese scientists have conducted a detailed analysis of the mineral's physical and chemical properties and composition. They said that the discovery will be helpful in understanding the local geological conditions and has provided clues for looking for lead, cooper, zinc and sulphide deposits. [Text] [OW221309 Beijing XINHUA in English 0723 GMT 10 Dec 82]

MARINE SEISMIC DETECTOR SYSTEM--Tianjin, 15 Dec (XINHUA)--China has developed a detector system for marine seismic geological surveying, the Marine Geological Survey Bureau of the Ministry of Petroleum Industry said today. The system, verified by experts as up to or approaching international standards in major technical norms, has been used in seismic geological surveying in the East China, the Bohai and Yellow Seas, and the results were as good as expected. A Marine Geological Survey Bureau engineer described the system as a 3-kilometer long device towed by a seismic surveying ship. Hydrophones in the device detect seismic waves caused by underwater detonations set off by the ship sailing along a prescheduled survey line, and then transmits electric signals to a digital seismic recorder on board the ship. Simultaneously, the signals are processed by a computer and translated into geological data. China began developing the system in 1979 and by April 1981, two types had been built. [Text] [OW221309 Beijing XINHUA in English 1230 GMT 15 Dec 82]

CSO: 4010/31

IMPROVED RADIATION SAFETY PRECAUTIONS FOR RADIOISOTOPE WORKERS IN SHANGHAI

Beijing JIANKANG BAO in Chinese 8 Aug 82 p 2

[Article by Fu Shanlai [0265 0810 0171] and Xu Huaijin [1776 2037 6815]]

[Text] Since the city of Shanghai decided to put into place an effective radiation safety program for radioisotope workers, the quality of such measures has continued to improve. Not only does this protect the health of those working with radioactive materials, it also protects the environment.

Radioisotopes were first used in Shanghai in 1958. During the last 20-some years, the Shanghai Health Department has adhered strictly to radiation safety regulations promulgated on a national level and has closely monitored the 166 newly built or remodeled units where radioisotopes or other radiation have been used. For the 78 units that practiced good radiation safety, a "Registration Permit for Work With Radioisotopes in Shanghai" was issued.

The fact that Shanghai can practice an effective safety program is due mainly to its reliance on the masses and the instigation of technical innovation. The Changning Hospital Center has used a micro-pump to successfully devise an automatic injection apparatus that is dependable and easy to operate. Use of such a device can reduce the exposure hazard for medical workers when they give injections that are radioactive. The First People's Hospital of Shanghai experimented and designed an automatic radium washer that can disinfect and substitute for most of the storage and assembling operations as well as wash. It needs only one operator, saves on labor, and cuts down radiation exposure dose. The Rujin Hospital is one of the earliest centers in the city to use radioisotopes for diagnosis and treatment. Following increased radioisotope use and overcrowding of nuclear medicine laboratory facilities, the radiation exposure dose for medical workers was obviously increased. Consequently, with collaboration from related groups, the medical and radiation safety personnel of this radioisotope laboratory initiated some radiation safety technical reforms and obtained good results.

In the disposal of medical radioactive wastes, the Shanghai Sixth People's Hospital joined with the Shanghai Industrial Construction and Design College and the Jingan District Environmental Sciences Society in 1979 to experimentally manufacture a model FH-1 water purifier, which can successfully

treat radioactive wastes resulting from medical and laboratory use. A joint collaboration unit at the Shanghai Institute of Industrial Health also successfully designed and completed an incinerator that can burn 20 kilos of radioactive wastes per hour. After several burnings, 27 tons of long half-life radioactive wastes have been processed, thereby reducing storage volume by 95 percent, weight by 96 percent, and presenting a new method to prevent inflammable wastes from contaminating the environment.

5292
CSO: 4008/216

TIBET LAUNCHES STOMACH CANCER SURVEY

Beijing JIANKANG BAO in Chinese 1 Aug 82 p 2

[Article by Shao Yongfu [6730 3057 1318]]

[Text] Stomach cancer is the most common malignant tumor affecting the health of the various national minorities in Tibet. According to statistics compiled from retrospective data on the causes of death from cancer for the whole region and from clinical autopsy data, stomach cancer is the leading cause of death, accounting for 48.89 percent of all cancer deaths. To better effect a program of stomach cancer prevention and control, and to protect the health of the Tibetan people, more than 20 medical workers from various local hospitals in Rikaze, Shannan and Lhassa, and the garrison hospital met and based their operation at the autonomous region's People's Hospital, and formed small groups to conduct a stomach cancer survey of the region. Given special funding and special medical equipment, they began their work in mid-April.

Selected as targets of the comprehensive survey were cadres and residents of various national minority groups in the city of Lhassa--the area with the highest incidence of stomach cancer in Tibet (stomach cancer mortality rate at 34.76 per 100,000). The general examination included an endoscopic examination and biopsy of stomach lining, and for certain individuals, a barium meal study. After a period of more than 2 months, a total of 1,234 persons, representing cadres, workers, peasants, residents, Army personnel and students of various minority groups had been examined. The results showed a 2.19 percent incidence of stomach cancer, with early cancer comprising 11.1 percent of those found positive. The incidence for duodenal cancer was 8.18 percent; for chronic atrophic gastritis, 15.5 percent; and for stomach polyps, 1.7 percent. Stomach cancer patients were hospitalized for surgery; other stomach conditions were treated accordingly. This comprehensive survey showed the incidence rates of stomach cancer and precancerous conditions in Tibet were markedly higher than that found in other provincial districts.

5292
CSO: 4008/216

ADVANCES IN DIVING MEDICINE RESEARCH BEING MADE

Beijing GUANGMING RIBAO in Chinese 17 Aug 82 p 1

[Article by reporters He Yi [6320 3015], Song Guangming [1345 0342 2494], and Zhao Yuelong [6392 1471 7893]]

[Text] At the recent Conference on Naval Construction for Progress, delegate and researcher Gong Jinhan [7895 6930 3211] of the Institute of Naval Medicine was cited for his painstaking work in diving medicine that has catapulted China's contributions to advanced international levels, and honored as a vanguard of socialist intellectual progress.

Gong, now 55 years old, graduated from the Tongji University Medical College during the early years of the Liberation, and decided then to concentrate on research in diving medicine. On 12 May 1963 then Premier Chou Enlai visited his compression chamber laboratory to inspect his research firsthand and showed great personal interest that made Gong even more determined to dedicate his life to this work. To find a method for treating decompression sickness and to systematically study specialized knowledge on diving medicine, Gong went to several large libraries in search of related data. He spent several months of his spare-time at a library going through a specialty index comprising several hundred titles gleaned from international journals, classified and abstracted relevant articles, and compiled a special bibliography on diving medicine with appropriate subheadings into specific subject areas. At other times, after perusing journal articles, he would write up "literature reviews." At present, he has already written 35 reviews totaling more than 600,000 words. He has also compiled over 2,000 valuable data cards, and kept voluminous notes. Over the years, his wealth of medical knowledge has surfaced in medical articles, translations, and teaching material.

In 1962, Gong simply applied pressure and cured a patient who had had decompression sickness for 136 hours. The following year, he successfully treated another diver who had been ill for over 2 years. In 1964, after much thought and review, he proposed the new concept of "chronic decompression sickness." At present, 101 cases of chronic decompression sickness have been successfully treated at his laboratory--the patient with the longest medical history had been ill for over 10 years, 80 patients were cured, comprising 79 percent of those treated; 21 showed marked improvement,

comprising 21 percent. This fact has revised the theory, proposed in foreign literature, that states that for cases of decompression sickness lasting more than 24 to 72 hours, the chances for recovery are remote. Gong's concept has created a new avenue of treatment for decompression sickness, both in theory and practice.

Though Gong Jinhan is in poor health, he has continued working. Once, after he was hospitalized for a coronary attack and given a month's rest, he plunged into intense preparations for a scholarly conference. This March, when several organizational units were jointly testing some imported diving equipment, and conducting a 200-meter helium-oxygen saturation diving test, he boarded the monitoring ship after his Beijing meeting was over, and chose to direct the safety of the exercise on site. During those days of intensive training, he only slept 9 hours in a 4-day period, even though colleagues were very concerned about his health. It was through such diligence and cooperation with others that this long and difficult training exercise and trial succeeded.

5292
CSO: 4008/216

AUTHOR: ZHANG Xinzhong [1728 3512 0022]
XIA Ying [1115 3853]
HE Kezhong [0149 0344 1813]

ORG: All of Qinghua University

TITLE: "A Precise Chinese Character Phototypesetting System"

SOURCE: Beijing ZIDONGHUA XUEBAO [ACTA AUTOMATICA SINICA] in Chinese No 4, 1982 pp 257-263

TEXT OF ENGLISH ABSTRACT: A precise Chinese character phototypesetting system controlled by a computer is presented. It consists of a big keyboard of Chinese characters, automatic phototypesetting machine and a check system consisting of a Chinese character generator and a laser scanning dot-matrix printer. The Chinese character generator is composed of 32 x 32 dot-matrix implemented with an E-shape soft magnetic core.

In order to guarantee the quality of characters and page format, to have a higher speed of phototypesetting and to make full use of the large difference in the frequency of usage of Chinese characters, the working principle of this automatic phototypesetting machine is to focus the image of all Chinese typeheads at different positions on the model plate into a small square by means of one big lens and several hundred small lenses.

[Continuation of ZIDONGHUA XUEBAO No 4, 1982 pp 257-263]

This machine has four typefaces: Song-dynasty-style typeface, imitation Song-dynasty-style typeface, blackface type and regular script. There are 10 sizes and 7 shapes for each typeface so that the machine may be considered as consisting of about 2 million typecasts.

9717
CSO: 4009/36

AUTHOR: None

ORG: None

TITLE: "Control Theory Committee of China Automation Society Held the 3rd National Symposium on Control Theory and Its Applications"

SOURCE: Beijing ZIDONGHUA XUEBAO [ACTA AUTOMATICA SINICA] in Chinese No 4, Oct 82 p 120

ABSTRACT: On 15-21 May 82, the 3rd National Symposium on Control Theory and Its Applications, sponsored by the Control Theory Committee of China Automation Society was held in Sichuan Province. There were 100 official delegates and 47 alternates, representing more than 90 organizations all over the country. The delegates were divided into 4 groups to listen to and discuss 81 papers; 3 teams were organized to introduce foreign researches on control theory and other special subject reports. A quarter of the papers delivered this time concern applications of the control theory in petorleum mining and production forecasting, space navigation, aeronautic industry, manufacturing of precision instruments, automation of production processes, biomedical fields , socioeconomic control, etc. Of the 81 papers, one third are written and delivered by young scientists, representing continuous emergence of new manpower in the field. The symposium resolved to call upon related organizations and departments to create favorable conditions for scientists to carry out theoretical researches on application, on simpler and effective methods of computation, on making softwares generally applicable, and on the gradual perfection of program designing and application, for the purpose of promoting the application of modern control theory.

6168
CSO: 4009/36

AUTHOR: LU Zulian [7120 4371 1670]

ORG: Shoudu Iron and Steel Company

TITLE: "The Practice of Increasing the Productivity of Shoudu BOF Plant"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 9, 1982 pp 18-24, 70

TEXT OF ENGLISH ABSTRACT: The BOF plant of Shoudu Iron and Steel Company, equipped with three 30-ton vessels, has kept to achieving over 4000 heats annually since 1978. In this article, a description of the principle observed for raising productivity and some special measures taken by the plant are given. Emphasis is made on the quality and stability of raw materials, smoothness and reproducibility of operations, scientific operating system which is chosen in the light of the plant's conditions to get comprehensive economic results, and full development of every operator's sense of responsibility so as to ensure every step in the operation being correct.

AUTHOR: FU Zuobao [0265 0155 1405]

ORG: Cold Rolling Works of Anshan Iron and Steel Company

TITLE: "The Improvement of Production Technique of Cold Rolled Deep Drawing Sheet for Automotive Industry"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 9, 1982 pp 25-29, 44

TEXT OF ENGLISH ABSTRACT: For the purpose of improving the deep drawing properties of automobile body sheet, according to YB 215-64 standards, three major decisive production processes in the whole procedure of production were studied and improved by our work (such as steel quality, hot rolling and cold rolling). It is considered that the steel quality is the foundation in hot rolling and three high and one low is the premise (higher heating temperature, higher rolling temperature, higher finishing temperature and lower coiling temperature); whereas in cold rolling, stable rate of reduction, two-step annealing and shot blasted roll surface are the more reasonable technical regulations. Very good results were obtained in production.

9717
CSO: 4009/35

AUTHOR: None

ORG: Office of Rare Earth Metallurgy

TITLE: "The 2nd Symposium on the Use of Rare Earth Metals in Cast Iron and Cast Steel Held by the Ministry of Metallurgical Industry"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 9, Sep 82 pp 75-76

ABSTRACT: On 24-27 Apr 82, the Ministry of Metallurgical Industry held its 2nd Symposium on the application of rare-earth elements in cast iron and steel for the purpose of exchanging the experiences of the past year, examining conditions of implementation of research plans, and discussing the development schemes prior to 1985. This symposium in Beijing was attended by 102 delegates representing 44 organizations. Since the 1st symposium,held in Dec 80, some progresses have been made in the field, including the rare earth magnesium nodular cast iron and steel ingot molds. Practices of long periods of time in Shanghai Bureau of Metallurgy, Qiqihar Steel Mill, etc. have proved that using this material can reduce 3-5 kg of mold consumption per ton of steel ingots, on the average. Techniques of using rare earth in metallurgical rollers and casting pipes have also been developed with obvious results of savings. These and other achievements are among the subjects discussed at the meetings and in the 27 papers received by the symposium. At present, problems concerning low temperature and high sulfur content of molten iron are being studied with emphasis at several organizations and investment capital is being arranged to reconstruct related equipment so as to extend the use of rare earth elements in metallurgy. Cooperative relationship among the related organizations is clarified along with research plans of the years before 1985.

AUTHOR: WANG Hanming [3076 3352 2494]

ORG: None

TITLE: "Symposium on the Reconstruction of Seamless Tube Rolling Mills"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 9, Sep 82 p 78

ABSTRACT: On 1-6 Jun 82, a symposium on techniques of reconstructing small machines of seamless tube rolling mills, under the auspices of the Seamless Steel Tube Specialty Group of Steel Rolling Committee of China Society of Metals. Participants included 65 delegates representing 36 units of seamless steel tube producing mills, institutes of higher education and research, and designing departments. The objective of the symposium is to investigate the direction of reconstruction of China's 76,100 seamless tube machines, to discuss concrete reconstruction schemes and measures to improve the quality of the products and to raise the economic benefits, and to find ways of expanding the type of products while reducing the consumption of materials. During the symposium, papers and speeches were delivered by 16 delegates. Finally, it is resolved to suggest that a nationwide steel tube research center should be established and that related departments of the Ministry of Metallury should organize manpower and materials to accelerate the study and application of some new techniques for reducing tensile stress, diagonal rolling, continuous rolling, etc.

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Beijing QIZHONG YUNSHU JIXIE [HOISTS AND CONVEYANCES] in Chinese No 7, 1982 pp 2-4

[Article by Xu Wei [6079 0251] of the General Bureau of Heavy Mining Machinery of the First Ministry of Machine Building: "Give Priority to Scientific and Technical Work"]

[Text] To enable the heavy mining machinery manufacturing industry to better adapt to the needs in economic readjustment and stable growth, the primary task is to readjust further the orientation of service, expand the scope of service, improve the quality of service, and improve adaptive capability.

In the course of realizing this task, we must first solve scientific and technical problems. This means we must give priority to scientific and technical work.

During these few years, scientific and technical work in the heavy mining machinery manufacturing industry has scored a number of achievements. In serving to provide daily consumer commodities, it has already directly manufactured several new types and has developed special machinery to process spare parts for various types of bicycles and sewing machines, and light industrial machinery such as beer-brewing equipment and sugar-refining equipment. It has expanded the varieties, specifications, and output of equipment for the production of such light industrial materials as aluminum plates, aluminum foil, welded pipes, and artificial board and improved their adequacy as complete sets of products. In serving the building sector, it has developed steel mold plates for pouring concrete, the production line to produce concrete beams and pillars, equipment to make bricks from furnace slag, and tower cranes for building higher stores of buildings. In serving technical improvements of various industries, it has provided many types of products for completing whole sets of equipment for work procedures in manufacturing medium and small rollers and for renovation of equipment. It has shouldered the task of improving small cement plants mainly by improving the grades of cement and by expanding output, and it has fitted construction machinery and hoisting equipment with many types of operating devices, or developed different-shaped products to adapt to the needs in different uses. In serving imports and exports, it has emphasized the improvement of the design and technology of such batch-manufactured products as chain blocks, jacks, and fork lifts, improved their quality, and reduced their cost. In conducting research in new technology, it has launched experimental research on many aspects, such

as the remelting of electroslag, the shaping of furan resin sand, the shaping of the heat insultating cap for externally cooled iron, the production of all-fiber interlocking extruded crank shafts, and gravity welding. These achievements have served importantly to readjust the direction of service and expanded the scope of service by the heavy mining machinery manufacturing industry.

But, we must also see that the scientific and technical work of some factories and research institutes is still in a relatively backward stage. There have been no outstanding breakthroughs in technology, there are no relatively long-range technical preparations, and progress in the buildup of scientific research bases is slow. All of these show that our scientific and technical work still cannot adapt to the needs of the objective situation.

Some personal views concerning problems in the present scientific and technical work of the heavy mining machinery manufacturing industry are presented in the following date to facilitate discussions with a broad range of comrades on the scientific and technical work front.

(I) We Must Clarify the Direction of Major Efforts; There Must Be Relatively Long-Range Plans

Each basic level unit must mobilize a broad range of engineers and technical personnel to forecast demand in domestic and foreign markets through investigative research, to combine efforts with the advantages and characteristics of each unit itself, to determine the major direction of one's own efforts in scientific and technical work, and to decide what new products can be produced within the near term, how old products can be improved, what product lines should be expanded to make whole sets, in which key technolgoies breakthroughs can be made, and how technical improvements in one's own unit can be made? After answering these questions, the direction can be clarified, the goals can be made concrete, plans can be drawn up and they can be implemented by the individual.

In particular, because the period of preparation for products of our heavy mining machinery manufacturing industry and the production cycle are both relatively lengthy, we must never grasp only the present in scientific and technical work and care only about what is before us. There must be a 2 to 3 year plan or a 3 to 5 year plan. Of course, we should also make readjustments or supplement deficiences according to changes in the situation at any moment during the course of carrying out such plans. Only in this way can each unit realize a definite initiative.

(II) We Must Start Out From Building Whole Sets, Familiarize Ourselves With and Master the Use of Technological Processes

Most heavy mining machinery is linked up in use according to the technological flow process to carry out continuous production. Therefore, it must be offered in whole sets to satisfy the demands of these processes. The broad ranks of engineers and technical personnel, especially comrades engaged in design and research work, must be familiar with and grasp the technological demands and flow processes of the user departments. In the past, we have had many weaknesses in this aspect. We cared only about facilities but not

the technology of use. We gave more consideration to single units of machinery, but gave less consideration to whole sets. For example, factories manufacturing crushers and ball grinders did not care much about other aspects of the mineral selection flow process and did not care about the coordination and the matching of facilities for ore selection that followed; therefore, they could not effectively improve the comprehensive technical level of whole sets of mining equipment. In these 2 years, some improvement have been made in this regard, but the situation must be completely turned around, and this requires a greater effort on our part.

(III) We Must Actively Develop New Products and Continue to Improve Old Products

The development of new products solves the problem of having or not having products. Improving old products solves the problem of the level of performance of products. Although present heavy mining machinery includes over 1,000 varieties of products in 401 series, there are still many types of equipment that are lacking. Therefore, new products must be actively developed. At the same time, old products that will always remain dominant in quantity must not be neglected. Old products cannot be retired except for those few in which changes and breakthroughs are made in principle and structure. After a certain period, old products actually become new products through continuous improvement from quantiative change to qualitative change. Take the hydraulic press as an example: Although it looks the same structurally and has always consisted of several large components--the main bar, the cross bar, the cylinder, and the plunger--and there have not been any major changes, nevertheless, continuous changes have been made in the method of transmission, in the efficiency of forging, and in precision control. The method of transmission has progressed from the sand box to steam pressurization and then to the high pressure pump with potential storage. In the last 2 years, the use of computer-controlled linkage between the hydraulic press and operating machinery has also been studied. Therefore, today's hydraulic press can be said to be an old product and it can also be said to be a new product, or more exactly, it is a new product proceeding from old varieties. The converter shows the same story. It was a new product in the middle of the last century, but later, the open hearth furnace emerged, so it had to step aside. At the middle of this century, the converter changed to the use of top blown oxygen and thus it was revived. This is the dialectic relationship between new and old products. Therefore, the experience of old products must be continually summarized. New technologies must be transplanted to them or grafted onto them so that they will remain young forever. At present, while improving old products, we should emphasize the improvement in quality, reduce the consumption of energy and raw materials in use, improve the use life of easily breakable parts and wear-resistant parts, and improve operating efficiency and reliability in operation. Old products can be kept in large quantities, and at a definite time they can be renovated. This favors improving economic benefits and technical improvements in all sectors. The future is broad.

(IV) We Must Emphasize Experimental Research

Scientific experiment is one source of correct human throught. Experimental research is the foundation of scientific and technical work. In the realm of our heavy mining machinery, the foundation in experimental research is very poor. During the Cultural Revolution, it was destroyed to a large extent. At present, we must regard it as a priority in scientific and technical work. Simply relying on theoretical estimation and mathematical calculations for a new product, a new improvement, or a new technology is frequently insufficient. They must also be proved by experimental research. Heavy mining machinery products are large. Some cannot be tested one by one or tested as a complete unit inside the factory. We should conduct simulated experiments, partial experiments, or experiment with parts and design the machinery units according to the results of experimental research. Some key technological processes in manufacturing also require experimentation. They can be applied in production only after the experiments have been successful. The whole machine must be subjected to load tests and technical performance tests before it leaves the factory. We should not take the factories and mines of the user departments as the labortories of manufacturing plants. Large foreign factories all have their own research and development centers. This is the root of their survival and the root of their ability to compete against similar factories. We must gradually establish and make sound the bases for experimental research and means of testing to create conditions for thoroughly changing the backward situation of heavy mining machinery.

(V) While the Enterprises Improve Products, They Must Carry Out Their Own Technical Improvement

In order to do a job well, the tools must first be sharpened. The major manufacturing plants of the heavy mining machinery industry are mostly over 20 years old. In the past, they have always been busy pursuing output, and with the destruction during the upheaval, the current technological means are outdated, and their own technical improvement cannot be delayed . Each enterprise should establish an improvement plan according to its own conditions and according to the urgency of the tasks. There are however, also some common aspects in the heavy mining machinery manufacturing industry that urgently need to be improved. For example, the hot processing system must be improved mainly to raise the internal quality of products and to conserve energy consumption; the entire welding operation line must be improved from preparing raw materials and removing rust to cutting, welding, removal of slag, and locating faults; and hard surface gear teeth must be popularized to improve the life of gears. In cutting work, advanced cutting tools have been used and digital display and numerical control devices are gradually being introduced. Of course, we should reduce power consumption as much as possible and appropriately rennovate factory buildings and equipment. The improvement projects in these aspects must be properly arranged one by one and implemented so that technical improvement of the industry itself can be carried out at the same time while carrying out technical improvements in other sectors.

(VI) We Must Correctly Handle the Relationship Between Organizing Efforts to Study Difficult Problems and Introducing Technology

In the course of scientific and technical exploration, it is common to organize efforts to study difficult problems or introduce technology from abroad to solve various difficulties. Our basic principle should be self-reliance. But to save time, we can introduce technology. During the last few years, we have tended to neglect introducing technology from abroad to hasten progress in solving major difficulties which otherwise require a relatively long time to organize our own efforts to solve. The technologies which we have introduced have not been conscientiously digested to establish a foundation for our own comprehension. There are a few projects which are carried out half-heartedly. While exploring the introduction of technology, full preparations should be made. To guard against the situation that arises when deals are unsuccessful, we must not relax preparations for organizing our own efforts to overcome difficulties. After introducing technology, we should convert our blueprints, standards and specifications to conform, and quickly utilize the technology, and in addition we should organize efforts to digest and understand the technology. This is a way to realize the goal of using introduced technology to improve our technical standards and to strengthen the capability of self-reliance.

(VII) We Must Strengthen the Technical Responsibility System and Disseminate It Into the Worksites

Without the responsibility system, plans cannot be implemented. In strengthening the technical responsibility system, we must advocate persistence from beginning to end and we must not change personnel midway. At least the main responsible people must not be changed. Only in this way can we train true technical experts. Now, there are too many managerial cadres in the technical departments while there are too few backbone technical personnel engaged in the projects. We must follow the spirit of simplicity and efficiency, eliminate some of the managerial duties of backbone technical personnel and let them serve as chief design engineers, heads of subject groups, and project chiefs and go to the front line of scientific and technical work. Engineering and technical personnel must conduct experimental research and serve production in the shops, and they should also go to the user departments to conduct installation and testing, work with the shifts, and visit the users on a regular basis. This is because they can truly examine whether the machines manufactured can realize the expected results only at the site of operation. In addition, they should go to the site of operation to serve the user departments on a regular basis, and they can thereby accumulate rich experience for us in improving products, developing new products, and researching new topics.

(VIII) We Must Continue to Learn and Improve Skills

Compared to the world's advanced nations, we are still relatively backward. To narrow the gap and catch up, we must continue to learn to improve our skills and talents. The broad range of engineers and technical personnel must learn in practice and they must pay attention to the following aspects of learning: First they must learn new technical knowledge. (Science and technology change constantly. If we do not study hard and learn, we will not

be able to improve our technical standards.) Second, they must acquire some knowledge of economics. (If engineers and technical personnel do not understand economics, scientific and technical knowledge cannot be used to serve the promotion of economic development well. For this, they must learn systems engineering, cost engineering, feasibility analysis, networking methods and managerial knowledge related to technical work.) They must also learn a foreign language well. (Foreign language is a tool. Engineers and technical personnel must at least be able to read foreign language technical information with the help of a dictionary.)

The above problems are important ones that must be solved so that scientific and technical work can become the priority. There are questions concerning ideology and working methods here. There are questions concerning work attitude and style, and it is possible that we have not covered them all and have not explained them thoroughly, and our views may not necessarily be right. It is hoped that the technical leadership at each level and the broad number of engineers and technical personnel in the heavy mining machinery manufacturing industry can join hands to consider, study and solve these problems together.

9296
CSO: 4008/218

CROMEMCO CHINESE CHARACTER SYSTEM DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 1

[Article: "Cromemco Microcomputer Configured into Chinese Character System"]

[Text] To enable several thousands of Cromemco microcomputers in our country to play a greater role in our national economy, the Mathematics Institute and Computing Center of the Chinese Academy of Sciences, and Wuxi Electronic Computer Plant conducted a joint study of the Cromemco systems, and came up with ways of adding on Chinese character (graphic) printing software, Chinese character (graphic) display control cards, and RAM boards without altering the hardware structure of the microcomputer systems, thus configuring them with means of inputting, editing, displaying, printing and processing Chinese characters and data. Though configured with Chinese language systems, the Cromemco machines still retain all of their original functions; the newly developed software systems provide a Western language/Chinese language switchover function, thus furnishing the Cromemco microcomputers with a relatively powerful means of processing information in either language.

This type of Chinese character system has been put to several months of practical use in scientific research, medical and military organizations with excellent results. It can be extensively used in other fields, such as business management, inventory control, information retrieval, information processing, file management, statistical reports, payroll computation, etc.

In October, the Wuxi Electronic Computer Plant will organize training classes aimed at completing the reequipping of Cromemco machines with Chinese character systems, popularizing the use of the systems, and helping users to develop a better understanding of Chinese character data base management systems and Chinese character BASIC.

9119
CSO: 4008/27

ZD-2000 CHINESE CHARACTER MICROCOMPUTER DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 1

[Article: "ZD-2000 Chinese Character Microcomputer Successfully Developed"]

[Text] Last September, the Computer Industry Administration of the Ministry of Electronic Industry organized a session to evaluate the ZD-2000 Chinese character microcomputer developed by the Yanshan Computing Center; the model was formally approved for batch production by North China Terminal Equipment Company.

The ZD-2000 Chinese language microcomputer is modular structured, using a microprocessor as the CPU. In accordance with the specific needs of users, various kinds of software modules and hardware modules can be selected and pieced together into different types of Chinese language microcomputers for various kinds of uses.

Following are three kinds of hardware configuration systems:

1. Basic System: Composed of microprocessor main control unit (32KB ROM, 16-32 KB RAM), Chinese character processing unit (4,096 Chinese characters internally stored), monochrome display unit, small size Chinese language printer, standard ASCII code keyboard, Vo24 communication interface, and cassette tape recorder.

2. Full-Configuration System: Includes following additions: floppy diskette drives, color display unit, medium size Chinese language printer (24 pins) and large pen-driven Chinese character keyboard (3,500 characters).

3. Expanded System: According to various kinds of uses, appropriate cards or external bus expandor boxes can be added to the system; other optional expansion addenda include 32 KB RAM expansion card, A/D and D/A converters, IEEE 488 interface, Vo24 serial interface, language input recognition card and light pen.

It has two kinds of software configurations. One is BASIC work mode, i.e., a BASIC language software system which supports Chinese character processing and editing. Under this mode, the system becomes a standalone Chinese language microcomputer which can be used as a workstation for handling transactions in Chinese. The other mode is known as terminal work mode. Under

this mode, the system becomes a terminal of a computer mainframe. To enhance response and processing speeds, the system's software is written in assembler language, and various kinds of operations are carried out by means of special function keys. The system can thus be used as an online Chinese language terminal or standard terminal for large or medium frame machines, as well as minicomputers or microcomputers; it can perform screen editing functions on data or documents offline, as well as point-to-point communication in Chinese.

The successful development of the Chinese language microcomputer has created conditions for further developing Chinese language information processing systems, Chinese language communication systems, and Chinese language computer networks; it has opened a new realm for the extensive use of computers in our country. It can be used in a wide range of applications such as processing of official documents, file management, cadre/personnel management, enterprise and economic management, census register management, and statistics for state institutions, factories and mines, commercial and cultural organizations.

9119
CSO: 4008/27

HCP CHINESE CHARACTER INFORMATION PROCESSING TECHNOLOGY

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 2

[Article: "HCP Chinese Character Information Processing Technology Users Association Established in Changsha"]

[Text] The Hunan Province Computing Technology Research Institute and Hunan Province Computing Center have successfully developed a Chinese character information processing system on Cromemco Z80-C microcomputers. They have also developed Chinese character printing technology for Dynabyte Z80-A,B microcomputers. These achievements are extensively used in some 20 provinces and cities throughout the whole country. In order to bring into play the social benefits of the system as soon as possible, and allow all users to exchange information and experiences, help each other tackle problems, and share resources, the "HCP Chinese Character Information Processing Technology Users Association" was recently established in Changsha City, Hunan Province.

All Cromemco Z80 or Dynabyte Z80-A,B microcomputer users who are interested in using the HCP Chinese character information processing technology can apply for membership. The members are expected to provide information on their application experiences and application situation; they can share all of the Association's achievements and resources at little or no charge at all.

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PROBLEMS IN CHINA'S MICROCOMPUTER DEVELOPMENT DISCUSSED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in chinese No 19, 5 Oct p 3

[Article by Professor Tao Shi [7118 2160], Computer Department of Guilin Electronics Industry College: "Five Problems Which Need to be Urgently Solved in China's Microcomputer Development"]

[Text] The growth of microcomputers in foreign countries is most astounding; every 3 years there is bound to be a minor change, and every 5 years a major change takes place. The 8-bit microcomputer which emerged in the mid-1970's has reached the stage of maturity; its hardware components are basically finalized in design, and its immense wealth of software is comparable with minicomputers. The 16-bit machine which appeared in the late 1970's has already gained a preliminary foothold in the market; its software is still in the midst of high speed development, but it is in the trend of replacing smaller machines. Several kinds of 32-bit microprocessors have emerged over the past few years; even newer CPU chips are continuing to emerge, and software development is still in the embryonic stage; but in view of the impending growth, it is predicted that 32-bit machines will eventually replace high-speed small frame machines. As to 64-bit microprocessors and systems, American and Japanese experts predict that by 1985, it will be possible to put the entire CPU of a medium frame machine into a single chip. At the estimated price of approximately $5,000, the system memory can hold as much as 1 megabyte and will have 100 megabytes of external storage with capabilities comparable to most medium frame machines. In light of the situation, our country must strive hard to catch up; it must work steadfastly for more results in production, research and development, and education. Following are five problems which the author suggests should be solved quickly:

1. Increase State Funding and Formulate Domestic Subsidization Policy

The state should concentrate capital investments in the research and development, as well as production of LSI circuits. The logic begind this lies in the fact that the average number of years for the economic and durable use of IC equipment is only 4 years. As large scale integration moves toward super large scale integration, and the width of wires continuously decreases from 5 micrometers to 3 micrometers and 1 micrometer, capital investment in production equipment correspondingly increases to three-fold and eight-fold, i.e., the ratio of investment in the three kinds of equipment becomes 1:3:8.

In Japan, most of the microelectronics industry (i.e., IC circuit industry) was developed between 1976 and 1979 with capital incentives totalling $500 million invested by the Japanese Government and private sectors. The West European Common Market powers spent $2.2 billion on developing microelectronic technology, e.g., the United Kingdom spent $800 million on purchasing production equipment, popularizing applications and education; France put in $500-$600 million. From 1976 to 1979, West Germany funded 1,564 million marks for promoting computer industrial manufacturing; production, research and development, and popularization of applications each accounted for one third of the above sum.

China is currently in the stage of economic restructuring, and it is not realistic for the state to invest enormous sums of capital funds in the computer enterprise. But perhaps it is possible to assign some of the factories, research institutes and educational organizations to computer work. According to latest statistics, the output value of computer industry in the United States accounts for 50 percent of the entire electronics industry; the output value of computer industry in the Soviet Union accounts for 30 percent of the entire electronics industry. Our country's computer industry is extremely feeble, and the output value is probably less than 10 percent. Is it possible to switch LSI research institutes and plants, as well as some electronic equipment plants into computer peripheral plants and equipment assembly plants, and have them all unified under the centralized supervision of the Computer Industry Administration so as to be able to study problems related to configuration and production of components, equipment and peripherals in a rational and unified way?

In view of the characteristic of LSI production, the manufacturing of a new chip often cost as much as several millions of yuan, and production cost will not come down until several years later when the annual output reaches over 10,000 chips. In the past, besides producing small quantities of 8-bit chips, China could only fit and package chips. As a result, production costs could not come down, and it was impossible to increase the percentage of quality products. Thus, while manufacturing large quantities of few types, our country should also provide appropriate amounts of financial aid to its LSI plants and research institutes. Otherwise, we can never compete with other countries or improve the quality of our products. This is also the experience of Japan and the United Kingdom in developing semiconductor industry.

2. Importation of LSI Modules and Microprocessors Should Be Centralized by the State

Over the past 3 years, some electronic industrial plants (and a small handful of universities and research institutes) have been importing micromodules, assembling them into single board processors and complete machines, and reaping enormous profits by selling them at prices five to ten times the original cost. This is detrimental to the domestic national industries, causing such enterprises and organizations to lose motive power for developing technology and rely more and more on imported modules.

I think we should formulate a computer growth policy calling for centralized importation of LSI modules and microcomputers by the state, and putting a stop to the importation of parts or machines which China can already produce up to standard. As to those products which can not be domestically produced for the time being, the state should import them under a centralized system and market them domestically at high tax rates; the tax revenue will be used by the state for subsidizing domestic LSI and microcomputer industries. Advanced technologies or complete projects which are imported with the approval of concerned departments should be allowed to come in at low or no import duties at all. This not only helps to protect the national industries, but also enables us to import indispensable advanced technologies and equipment.

3. Produce PDP-11/23 Grade Computers and Use Them as Standard Models for Promoting Extensive Use of Computers in Our Country

Two problems have to be solved in order to promote the extensive use of computers in our country: First, we should provide domestic users with tens of thousands of fairly powerful but comparatively low-priced 16-bit computers (8-bit machines do not meet memory or capability requirements of general users). Second, we should train a contingent of people who have expertise in computer hardware and software, as well as user service.

Then, what kind of computer should be chosen for massive production and popularization in this country? In CHINA COMPUTERWORLD No. 12, 1982 issue, Li Tieying [2621 6993 2503] and Ta Yuming [1044 3768 6900] proposed to import PDP-11/23 structure. I agree with them. LSI-11/23 is a single board machine; PDP-11/23 is a minicomputer microminiaturized system composed of LSI-11/23 plus other components. It has the same capabilities as PDP-11/34; its processing speed is equal to 90 percent of PDP-11/34; its operation time is 1.7 microseconds, standard memory 128 KB, and can be expanded to 256 KB. Among the various kinds of minicomputers, the PDP-11 series has the richest library of software. The CPU of LSI-11/23 is composed of three chips; each chip integrates some 10,000 transistors. Our country is fully capable of producing such chips. In fact, some of the research institutes in China have had many years of preparation and are currently engaged in this kind of work.

In China, due to the "import fad" over the past 2 years which has been detrimental to our national computer industry, the marketing of products produced by quite a few domestic computer plants and peripheral factories has come to a standstill. If the Computer Industry Administration vigorously promotes research and development of a prototype model scheduled to be completed by 1983, and begins to produce 10,000 machines in 1984 and 1985, it would then be possible to galvanize ten LSI circuit plants, peripheral plants and computer assembly plants into full-steam production, and research institutes and schools of higher education could also be actively engaged in the development of support software and popularization of the machine. The current import price of a PDP-11/23 machine is approximately 150,000 yuan (128 K memory, configured with hard disk printer and four video display terminals). If we plan to domestically produce machines configured at the price of approximately 150,000 yuan, the gross value of 10,000 machines would be 1,500,000,000 yuan,

which is sufficient for moving the entire computer industry of our country onto a properous road, and laying foundations for future growth.

4. Establish Microcomputer Research Institute and Conduct In-Depth Research on PDP-11/23+, 16-bit Microprocessors and Systems

The Ministry of Machinery Industry has already established a Microcomputer Application Research Institute in Hefei Industrial University; remarkable results have been achieved over the past few years, which has greatly helped the popularization of microcomputers. The Ministry of Electronics Industry and Computer Industry Administration will also set up research institutes devoted to the development of microcomputers, and satisfy the needs of the growth of microcomputer technology in this country.

At present, the microcomputer research institutes should first of all conduct in-depth study of PDP-11/23+ and Micro/PDP-11 to serve as reference for improving PDP-11/23 type machines. Digital Equipment began marketing these two new products in 1982.

PDP-11/23+ employs the improved version of LSI-11/23A. Its main memory can reach 1 MB, uses 10.4 MB disk controller and supports 1 MB direct access memory space. The capabilities of this system are comparable to PDP-11/44. It is said that the memory of PDP-11/23+ can be further increased to 4 MB, and the storage wordlength can reach 22 bits, which makes it almost comparable to PDP-11/70.

Micro/PDP-11 uses the CPU of PDP-11/23+; highly integrated modules are installed in its 5.75 inches tall case. It has 256 KB memory, 22 bits addressing capacity, 10.8 MB Winchester disk, controllers and power supply. The system can support eight online users, and is mainly used for computer-aided designing in engineering, process control, automatic testing, and instrument control. This type of system can also be used in distributed processing systems, and DECnet and Ethernet networks, which have become quite popular in recent years and are of reference value to further developing distributed computers and computer networks in this country.

As to 16-bit microprocessors, the author believes that is is rather premature now to decide which model to choose.

In the author's opinion, the best approach is to spend a few years conducting preview studies of Z8000, 8086 and 68000 microprocessors and systems; model selection, full scale work and investments in production should wait until 1984.

The best thing to do now is to establish microcomputer research institutes in the same vicinity as computer assembly plants and computer colleges, thus allowing them to coordinate with one another, and jointly promote the growth of the computer enterprise. If funding is a problem, then perhaps it is possible to first establish computer colleges and temporarily set up research institutes on their campuses; the research institutes should be initially staffed with 50 employees, and gradually developed.

5. Establish Computer Colleges and Training Schools Primarily Aimed at Training Microcomputer Personnel

Sponsored by the Computer Industry Administration, Beijing University has established an affiliated school primarily for software engineering. This affiliated school should be expanded into a computer software engineering college. Besides, the author suggests setting up another computer college or converting one of the four colleges affiliated to the Ministry of Electronics Industry into a computer college which should have departments of precision machining and peripherals, computer communication network, computer science (mainly software), microcomputer engineering (software and hardware combined), microprocessor and microcomputer application, computer control, etc. The computer science disciplines and faculty members of the four colleges need some readjustments and centralization to enable our country's computer science and industry to move forward in large strides. In addition, it is also necessary to set up another computer training school for training programmers and computer peripheral and overall assembly technology personnel; or, perhaps we could set up polytechnic schools on college campuses which would be equivalent to 2-year colleges in the United States and Japan.

Some people think that the training of computer personnel in our country has reached the point of saturation, and that there will be no job vacancies for future graduates. The author believes that the "surplus personnel: theory is merely a superficial phenomenon related to the temporary standstill in the marketing of domestically produced computers. If tens of thousands of machines with PDP-11/23 capabilities are manufactured as suggested in this paper, there will be a shortage of personnel in plants and research institutes, and more people will be especially needed to popularize the machines. The computer enterprise in our country will have a spring of vigorous growth!

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ENGLISH-CHINESE GENERAL-PURPOSE MICROCOMPUTER OPERATION SYSTEM

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 7

[Article by Xiao Ping [5618 1627] and Chen Mei [7115 5448], Jiangsu Province Computing Technology Institute: "English-Chinese General-Purpose Microcomputer Operation System--EC-DOS"]

[Text] With the development of microprocessor application, many users look forward to the development of microprocessors which can process Chinese character information. For the general user, a Chinese character processing system should have adequate software support, i.e., all kinds of high-level languages which can recognize and process Chinese characters. System software expenses would certainly increase sharply if we were to redesign high-level languages for this purpose. Thus the best approach is to fully exploit available system software resources while making them meet the preceding requirements. In order to do this, two aspects have to be taken into consideration: First, something has to be done to make the system software (e.g. assembler, high-level BASIC, FORTRAN and COBOL languages) of available systems recognize Chinese characters without altering the language compiler programs. The available utility programs should also be fully utilized and enhanced with Chinese-character processing capability through only a minimal amount of modifications. Apart from this, new systems with expanded capabilities to process Chinese language information should retain all the functions of the original system, thus turning them into systems capable of processing both Chinese and Western languages.

Our research was conducted on a Dynabyte A machine. Its CP/M operating system was expanded with newly developed EC-DOS (English/Chinese universal disk operating system) capabilities which are compatible with CP/M. All of the original system software programs can run under the EC-DOS operating system, and have the additional capability of recognizing and processing Chinese characters. Thus, the compiler programs of all high-level languages can be used without need for making any kind of modifications, and the users do not have to worry about any additional rules or requirements.

Modification and Expansion of CP/M

As we are already familiar with the three layer structure of the CP/M operating system, i.e., CCP, BDOS and BIOS, it will not be discussed here.

Two things have to be done in order to add Chinese character processing capability to the operating system: First, its I/O must have the ability to recognize Chinese characters; second, it should be able to convert Chinese characters into standard ASCII character set exchange codes. This will allow the system to process Chinese characters in the same way as processing ASCII characters. To meet the first requirement, a new operating system, EC-DOS, is developed by making minimal changes to BDOS and expanding BIOS. The expanded portion is called CCH as shown in the accompanying figure; it includes input processing and output processing units. The input processing unit recognizes Chinese characters, and can convert Chinese characters into standard ASCII form exchange codes. The Chinese recognition characters are built into the unused portion of the ASCII character set. The output processing unit recognizes Chinese characters, selects dot matrices from the Chinese character word bank and sends them to the buffer zone, and drives the peripherals.

As Chinese recognition characters and input Chinese character codes are converted into ASCII characters, high-level languages can thus process Chinese character strings in the same way as ASCII character strings, thereby creating basic conditions for the use of high-level languages.

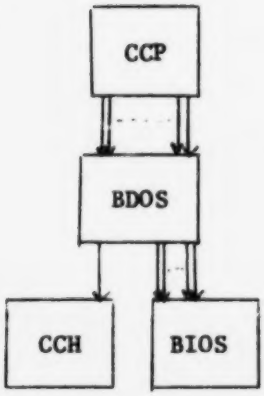
The expanded portion [of the operating system], is stored on floppy diskette as an auto-execute file; when the system is booted, CCH is automatically loaded into the memory and combined with the modified CP/M to form the EC-DOS operating system. As the Chinese character process function is the expanded portion of the operating system, there are no special requirements for Chinese character I/O equipment. All that is required is to make corresponding modifications and expansions in the CCH for different types of Chinese input equipment, coding methods and output equipment.

A Comparatively Practical System

We tried hooking the system onto a Chinese character wire printer produced by Suzhou Shengli Radio Plant; the original system's Western-language keyboard was used as the imput device (the Chinese character coding method developed by Zhi Bingyi [2388 4426 1744] of Shanghai Instruments Research Institute was used for inputting and coding Chinese characters), and the original CRT was used as the character display unit, thus forming an English/Chinese interchangeable microcomputer system. In the experiment, we used Cromemco's BASIC, FORTRAN and COBOL languages, and the desired results were achieved. A payroll program originally developed in BASIC was used in the experiment with slight modifications in character string lengths, and repalcements of original ASCII character strings with corresponding Chinese character strings. The program functioned properly.

As Cromemco System-3's CDOS operating system is compatible with CP/M, and their structures are similar as well, Cromemco System-3 can also process Chinese character information by making similar modifications and expansions in CDOS. It can be converted into a feasilbe English/Chinese interchangeable microcomputer system by adding Chinese character peripherals and a Chinese character word bank.

Figure: EC-DOS Structure



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NEW MICROCOMPUTER-CONTROLLED SIGNAL SYSTEM FOR HYDROPOWER PLANT

Beijing JISUANJI SHIJIA [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 1

[Article: "Gezhou Dam Hydropower Plant Employs New Microcomputer-Controlled Signalling System"]

[Text] The Gezhou Dam Hydropower Plant has many generating units with all kinds of primary and auxiliary equipment requiring a multitude of monitoring signals. The units, moreover, are dispersed over a fairly wide area, not to mention the important role Gezhou Dam Hydropower Plant plays in the Central China Power Grid, which calls for even stringent requirements in safety and monitoring measures. In late 1977, the Nanjing Automation Research Institute of the Ministry of Water Conservancy and Electric Power, the Planning Office for Changjiang [Yangtse] River Basin, and inland pilot power stations began to develop the SXJ-1 accidents sequence display/recording device which was put to trial use for one and half years by inland pilot hydropower stations. The device was recently evaluated and approved by the Ministry of Water Conservancy and Electric Power. The evaluation board agreed that the device was "properly designed, reliable, and stable." The device also has such features as "expandability and resistance to interferences." It is now in full operational mode in Gezhou Dam Hydropower Station.

The device can monitor more than 750 kinds of signals covering the entire plant's accidents, malfunctions, and operations on a single 19 inch color screen. Chinese characters in different colors are used on the display unit for distinguishing the nature of the events, and the system can monitor the entire sequence of accidents and malfunctions in the plant with microsecond-level precision. It can display the main power nodal lines of the plant, call back the historical sequence of all kinds of signals, and accomplish other kinds of man-machine interactive functions. It has played a fairly useful role in the drive to improve the level of safety operations.

The device is equipped with a SD 078A microcomputer (6800 CPU) which is newly developed by the Nanjing Automation Research Institute. It has excellent universality, and meets the needs of power stations, transformer stations, and other users. As the device can output Chinese characters, it is possible to vastly improve discriminability under emergency conditions by adopting a hierarchical dispersed signal gathering system. The device also saves signal cables and is easy to set up.

With the exception of ten-odd imported LSI chips, the overwhelming majority of components of the device are supplied domestically, and it can be manufactured in this country.

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COMPUTER SCIENCE DEPARTMENT ESTABLISHED IN XIAMEM UNIVERSITY

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 2

[Article: "Computer Science Department Established in Xiamem University]

[Text] The Computer Science Department of Xiamem [Amoy] University was officially established this year. At present, two disciplinary courses are offered: software and cybernetics. There are 30 new students enrolled in each of the courses this year. Professor Li Wenging [2621 2429 3237] is director of the department.

There are plans to construct a computer building covering 1,800 square meters of land in 1983. Preparations for the project are well underway now. The building will be used mainly for accommodating a medium frame computer and a minicomputer.

At present, the Computer Science Department already has two DJS-130 machines, one HP-85 microcomputer, and four Audromeda-11/B microcomputers. It plans to add more computer equipment in the future.

The academic activities of the Computer Science Department of Xiamen University are guided by an open door policy, i.e., employ scientific and technical personnel from various outside sources, including domestic sources, foreigners and overseas Chinese; anyone who is interested is welcome to work for Xiamen University.

The Department also welcomes scholars from both in and out of the country to come to teach at the university. Computer specialists from neighboring Taiwan Province are also welcome to visit or lecture, and thus promote mutual understanding and academic exchanges.

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SIXTH ANNUAL MEETING OF COMPUTER SOCIETY

Beijing JISUANJI SHIJIA [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 1

[Article: "Sixth Annual Conference of Computer Society Convenes in November]

[Text] The Sixth Annual Conference of the China Computer Society of the Electronics Institute will be held in Zhengzhou from the 5th to 11th of this coming November. At the conference, an election of committee members will be held, and the participants will explore the relation between China's computer science and technology enterprise and the development of science. The meeting will study and probe into the overall situation underlying the question of how to develop computers in our country.

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COMPUTER AIDED SOFTWARE TRANSPLANT

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 7

[Article: "Computer Aided Software Transplant"]

[Text] To expand the application range of a computer system, under certain circumstances, we often have to transplant software from another computer system. The common practice is to analyze first before transplanting, i.e., first analyze the software of the other system before transplanting it to our own system. The task can be quite formidable when the software contains a large number of programs but lacks adequate documentation. Recently, the Shanghai Computing Institute sucessfully transplanted the ISIS-II operating system, 11 utility programs, and the compilers (interpreters) of 4 languages (macroassembler, BASIC, PL/I and FORTRAN) of an Intel MDS-230 microcomputer development system to a Chinese-made 056B/C microcomputer computer by means of a computer aided method instead of the conventional way.

The results of the new method are quite remarkable: It takes only 0.5 man years to transplant 600-700 KB of programs. It is reported that in the not too distant future, this project will be evaluated together with the 056 B/C microcomputer.

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CONFERENCES ON COMPUTER APPLICATIONS, DISPLAY TERMINALS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 19, 5 Oct 82 p 15

[Article: "News Briefs on Meetings"]

[Text] From October 16 to 19, a marketing session will be held at A-1 Beihuan Xilu in Beijing. Customers can place orders for DT-110 character display terminals produced by Beijing Computer Peripheral Plant No 1.

From October 21 to 25, a DJS-100 series Computer Educational System Application Exhange Meeting will be held in Xi'an City's Xiaohan Hotel, and will include the following topics: general report on computer networks, application of computers in school administration, library catalog searching, etc. There will also be a demonstration at the meeting. The TP801 single-board computer will be put on exhibition as part of a marketing effort. The meeting is jointly sponsored by Shaanxi Bureau of Higher Education, Northwest Branch Association of the 100 Series Users Association, and Suzhou Electronic Computer Plant.

An academic symposium on display terminals will be held in Wuhan City in October. The Computer Society of the China Electronics Society will organize the meeting. Some forty papers will be presented at the symposium and will cover the following four major topics: (1) image and graphic display, (2) alphanumeric display, (3) special techniques, (4) Chinese character display and information.

The Computer Society of the China Electronics Society will sponsor an academic meeting from the 16th to 23rd of October 1982 in Lushan, Jiujiang City, Jiangxi Province for the exchanging of experiences on the maintenance and use of automatic plotters. A total of 63 academic papers will be presented at the meeting. The meeting will be jointly hosted by the Technical Division of Jiangxi Province's Electronics Industry Bureau and Jiangxi Province's Jiujiang Radio Plant No 2.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

HUANG WEILU, LAUNCH VEHICLE CHIEF DESIGNER PORTRAYED

Beijing GUANGMING RIBAO in Chinese 21 Oct 82 pp 2-4

[Newsletter by correspondents Sun Yinnan [1327 1714 0589], Ren Wanzhi [0117 5502 1807], and Ren Xianzhong [0117 3759 1813]: "Giving One's All for Spaceflight"]

[Excerpts] In the history of China's aerospace industry, many scientists, technicians, Party officials, as well as commanders of the Liberation Army, have contributed much of their labor, sweat, and blood to the success stories of many aspects of the industry. A typical representative of this group is comrade Huang Weilu, [7806 4885 4389], vice chairman of the scientific and technological committee of the Ministry of Aerospace Industry, deputy director of the Office of Chief Engineer, and chief designer of several rocket models.

Huang Weilu graduated from the original Zhong Yang University (now the Nanjing Engineering College), and later went to England for his graduate study. At that time, the second World War was in progress, and he witnessed many weak countries falling victims to the aggression of powerful imperialists. He became convinced that the survival of a nation or a people is closely related to the development of science and technology, and he was determined to make China regain its strength. With this determination, he returned to China in 1947.

In the mid 50's, when the aerospace industry in China was just being established, he participated in a major role of the research work in rocket control systems. Later, he directed the automated designs of the control systems on a number of China's rocket models, and made significant contributions to China's rocket development.

In the late 70's, Huang Weilu assumed the responsibility of chief designer of China's new rocket models and made further contributions to the aerospace industry.

During the past 20 years, Huang Weilu never questioned his work; he would go any place and take any job that was assigned by the organization. Regardless what the assignment was, he always worked diligently and completed his task with perfection. Step by step, he marched along the road of

science. He was considered the unnamed hero of science and a model representative of the scientific community.

(1) A scientific worker who loves his Party, his people, his country, and the socialist cause is, in general, totally dedicated to his career. Huang Weilu is such a devoted scientist. His sentiments toward the Party and the people are reflected in his totally selfless sense of responsibility in his work. It has been commented that rockets have become a part of his life.

In 1970, he was transferred to a job 60 li from his home. At that time, his three children were laboring on farms in the provinces of Heilongjiang and Yunnan; only his ailing wife and a 70-year old cousin were living with him. In spite of the long commuting distance, he never complained. In fact, since his unit's shuttle bus was not reliable, he often rode his bicycle to work. Once, he had an accident and broke his arm, but he did not say a word. Unable to ride the bicycle, he started riding the public bus to work. The bus route required three to four transfers between his home and his office, and it took him 3 to 4 hours each day, but he continued to keep his regular work schedule. Last October, returning from a business trip, Huang found his cousin home by herself; his wife was in a hospital waiting for major surgery. As he was again scheduled to participate in a technical conference, his superiors advised him not to attend. But he ignored it and departed immediately.

Due to prolonged hard work, Huang Weilu's health deteriorated. He suffered a variety of diseases: cataract, high blood pressure, ulcer, bone disease, and bronchitis; he was also running a low fever continuously. Nevertheless, he continued to devote all his energy to his work for the Party.

Once during the flight test of a launch vehicle, he was disturbed by the bad test results, and was listening to the opinions of his colleagues and at the same time performing calculations to determine the cause of failure. Noticing that Huang was covering his abdomen with his hand, his colleagues called the base doctor. The diagnosis was "thrombosis in the veins." The base commander wanted to send him to a hospital in Beijing immediately, but Huang said, "I cannot leave the scene before this problem is resolved." Finally, after repeated persuasion, he agreed to go back to Beijing for treatment. During his stay at the hospital, he learned of problems with the test of another rocket model. He immediately went to the test site and participated in the investigations and analyses until late at night when the problem was solved before returning to the hospital. In February of this year, Huang Weilu hosted a national conference. On the first night of the conference, he began to run a fever, and discovered blood in his stool. He figured it was caused by the chronic ulcer which resulted in bleeding from the stomach. Although he clearly realized the seriousness of the disease, he still insisted on completing his duty as chairman of the conference. Not until the end of the 5-day conference did he go to the hospital for checkup and treatment.

On another occasion, Huang traveled from Beijing to a launch vehicle test site to participate in a flight test. Because of the colder climate at the

test site, he came down with a severe cold, and suffered a high fever. But he still busily labored among the various work areas. On the evening of the final inspection, he was relieved of duty because of his physical condition, but he walked two li (Chinese miles) to the work site and stayed until the next morning.

(2) The following story has been circulating among the staff members of Huang's unit.

Once, during the "5-minute countdown" period before the launch of a rocket vehicle, the voltmeter in the feedback circuit of the 1st stage servo began to fluctuate. Upon hearing the report, Huang asked, "Is the platform all right?" The reply was "Yes." After pondering for a few seconds, he decided, "Launch as scheduled!" Everyone in the command center was sweating over his decision, but upon ignition the rocket roared skyward, and the flight test was a complete success. When the voltage fluctuations occurred before the launch, he judged it was caused by external factors which he had encountered during previous ground tests. Therefore, he was able to make the decision which resulted in cheers of victory.

In dealing with a problem, Huang always conducts careful research, and thoroughly investigates the practical aspects of the problem. He believes in a democratic approach to solving technical problems. Huang's colleagues consider him to be not only a knowledgeable and experienced commander who is capable of handling complicated technical problems, but also an open-minded leader who will listen to all different opinions.

(3) Aerospace projects are very expensive. A slight mistake may result in great financial losses to the Party and to the country, and may nullify the fruits of labor of thousands of people. As a technical director, Huang Weilu is fully aware of the responsibility on his shoulder.

During one of the rocket tests, the horizontal amplifier exhibited erratic behavior; the technicians were all discouraged because after an extended search no one could find the cause of the malfunction. When Huang arrived on the scene, he first tried to encourage his staff by asking them to concentrate on the "erratic" nature of the problem, then he joined in the testings and analyses. After personally disassembling the amplifier, he found a small iron chip on the relay unit, which cause the relay to behave erratically. Thus, the problem was solved.

During another assembly test of a rocket, the output signal of a transform amplifier exhibited irregular interferring "spikes." After a long search, it was found that the amplifier was affected by the operation of a crane in the workshop. However, Huang Weilu was skeptical about this conclusion, and suggested repeating the test under a different environment. The results showed that the interferring "spikes" were actually caused by one of the components of the amplifier itself. Thus, a potential problem was removed by replacing this component. The comrades at the test site were all very appreciative of Huang's effort in preventing a possible disaster.

Before every flight test, Huang always ensures that a team is organized to perform quality inspection, and to conduct exercises of imagined incidents in which potential problem areas and trouble spots are listed, and then the method of solution for each problem and preventive measures are presented. Thus, most potential difficulties are eliminated before the rocket is launched.

(4) Huang Weilu is specialist from the old society. After being educated by the Party, he was given the privilege in 1960 to join the Chinese Communist Party. Since that time, he has constantly placed demands on himself to meet the standard of a Party member. During the 3 years of natural disaster, considering the hardship faced by the Chinese people, he often refused the special benefits of living comforts given to him by the government. During the period of political struggle, he never made any comment which was against his conscience, and he never did anything contrary to the interest of the Party. Everyone considers him a friendly and easy-to-get-along chief, and enjoys working under his leadership.

Although he is quite well-to-do financially, he lives a rather austere life. Once he attended a meeting in the workshop dressed in his old cotton robes, he was mistaken for just another old technician. On the topic of automobile usage, Huang has the following rule: automobiles will not be used for private business, for transporting relatives, or for carrying family members. Huang's character and model behavior won praises from many scientific personnel, factory workers, Party officers, and military commanders.

In 1980, he was elected representative to the 7th Beijing citizen's convention, and was given the title of model worker. In 1981, he was named a "superior Communist Party member" and a "model soldier in the field of scientific research." In 1982, he was again named the "model worker of Beijing." In spite of all the praises and honors given to him, Huang still maintains his usual modest and conservative attitude. He always said, "The Party and the people have given me so much, and I have done so little for them."

3012
CSO: 4008/30

AUTHOR: JIAN Zequn [6456 3419 5028]
HE Hongqing [0149 3163 1987]

ORG: None

TITLE: "A Study of the Prediction of the Starting Transient Process of Solid Propellant Rocket Motors"

SOURCE: Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 4, 31 Oct 82 pp 44-51

TEXT OF ENGLISH ABSTRACT: The interior ballistic P(x, t) model of the starting transient process of the solid propellant rocket motor has been improved in the present paper, with the aim of ensuring better accordance with the actual working conditions in the motor. The numerical solution of the governing equations, pertaining to one-dimensional unsteady gas dynamics, utilizes an implicit finite difference scheme combined with the method of characteristics. The computed pressure-time curve is in fair agreement with the experimentally measured one. It is evident from the results of computation that erosive burning is a main factor affecting the starting pressure-peak for a given propellant geometry, and the heat exchange between the combustion-gas and the solid propellant casts a great influence upon the processes of ignition-induction and flame-spreading.

[Continuation of YUHANG XUEBAO No 4, 31 Oct 82 pp 44-51]

Moreover, the rate of pressure change also plays an important role in the phases of flame-spreading and chamber-filling, and should hence be accounted for in the prediction. The computation program presented should provide a general means for the interior ballistic curve of accurate prediction of the starting transient process as well as for the investigation of the influences on it of the various factors involved.

AUTHOR: LIU Shenzhao [0491 1957 6856]

ORG: None

TITLE: "Sequentially Controlled Active Acquisition System of Gravity-gradient Stabilized Satellite"

SOURCE: Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 4, 31 Oct 82 pp 52-64

TEXT OF ENGLISH ABSTRACT: This paper is concerned with the sequential control principle of an active acquisition system of gravity-gradient stabilized satellite with minimum hardware. In this system yaw sensors are not used and the velocity damping is realized effectively by using logical circuits to process infrared horizon sensor's information and, therefore, the expensive feedback packages are saved. Computation results show that this kind of control system is very powerful in adapting to launching the vehicle and gas jet actuator with eccentric thrust. It is possible to get much higher acquisition accuracy with a reasonable choice of system parameters. Unlike the traditional acquisition methods, a new acquisition concept is proposed in the paper.

9717
CSO: 4009/47

AUTHOR: BAI Feng [4101 6912]
WANG Yongping [3769 3057 1627]

ORG: None

TITLE: "The Importance of Light Diesel Trucks in Country Transportation"

SOURCE: Beijing QICHE GONGCHENG [AUTOMOTIVE ENGINEERING] in Chinese No 4, 1982 pp 1-6

TEXT OF ENGLISH ABSTRACT: In the PRC, almost 80 percent of the population is in the country. We have complicated terrain, with plains comprising only 12 percent of the total. Before liberation, manual labor was the main source of country transport. During the 1950's, heavy-duty bicycles, bicycles with trailers, hand-push carts and pneumatic-tire horse-drawn carriages were used extensively in country transportation. This was great progress. Beginning in 1979, both farming and industrial economy in the country advanced by leaps and bounds. The demand for trucks, especially those that were diesel powered, appeared because the amount of country highways reached 585,000 km, and experience had already been attained in using diesel engine powered tractors and irrigation pumps. At the end of 1981, the number of trucks in the rural areas had reached 175,000, including 40,000 diesel-powered vehicles.

AUTHOR: LIU Jiahe [0491 1367 7729]

ORG: Parts Design Office, Second Automotive Construction Works

TITLE: "Introduction to Engine Electronic Control (EEC) and a Preliminary Study of Its Usage in China"

SOURCE: Beijing QICHE GONGCHENG [AUTOMOTIVE ENGINEERING] in Chinese No 4, 1982 pp 22-27

TEXT OF ENGLISH ABSTRACT: This is an introduction of the status quo of EEC in the world. Then, a preliminary study of the feasibility of the adoption of this technique in China is given.

9717
CSO: 4009/52

AUTHOR: YANG Qizhong [2799 0366 0022]

ORG: Department of Mining Engineering, Chongqing University

TITLE: "Development of Wind Tunnel for Calibrating Mine Airmeter"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 118-130

TEXT OF ENGLISH ABSTRACT: The development of a wind tunnel for calibrating a mine airmeter is one of the research subjects that needs an immediate solution for safety in coal mining. The measuring device described in this paper is based on Bernoulli's law and the fluid continuous law. Referring to domestic and foreign relevant materials, the device was successfully constructed after a three-year investigation. It consists of three parts: a) a tunnel system creating a uniform flow field; b) electrically controlled circuit with voltage regulation and stepless speed regulation; and c) air speed monitoring instrument system, including traditional dynamic pressure measuring system with pilot tube, and some new methods such as photoelectric and electronic frequency measurements.

This paper introduces only the design of the wind tunnel. The accuracy of measurement with this wind tunnel is up to 1.3 percent, while the accuracy required in the standards published by the Ministry of Coal Industry of China

[Continuation of CHONGQING DAXUE XUEBAO No 3, 1982 pp 118-130]

is 1.5 percent. With this wind tunnel, one can calibrate the mine airmeter for low, medium and high air speeds ranging from 0.2 to 30 m/s. In addition, this wind tunnel may be used for calibrating the pilot tube and conducting experiments with respect to hydromechanics.

AUTHOR: WEN Qingdong [5113 1987 2639]

ORG: Heat Power Engineering Department, Chongqing University

TITLE: "Research on an Automatic Solar Tracking Installation"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 131-135

TEXT OF ENGLISH ABSTRACT: The automatic solar tracking installation recommended in this paper is composed of the DDZ-II type conventional process controller, a tracking sensor and an automatic initial position returning mechanism. Among the striking features of this installation are high output torque, fast response, reliability and low cost. With the use of the silicon controlled rectifier and speed reduction by planet gears, the installation is expected to have long service life and high transmission efficiency.

The installation also has many desirable functions, such as east-west direction automatic tracking, electric remote control tracking and automatic return, etc.

The installation can be used as a solar tracking system in large and medium scale solar power generation units. It can also be used as an experimentation stand in solar energy research laboratories.

9717
CSO: 4009/64

AUTHOR: None

ORG: None

TITLE: "Brief News of a Conference"

SOURCE: Guangzhou JICHUANG YU YEYA [MACHINE TOOL AND HYDRAULICS] in Chinese No 5, 15 Oct 82 pp 48-49

ABSTRACT: On the basis of suggestions of the 132 delegates attending the National Hydraulic Servo-Control Mechanism Teaching and Learning Conference of Aug 81 in Kunming, the Yunnan Provincial Science Association and the Kunming College of Engineering, under the direct leadership of the party committee, spent a year to prepare for the Conference for the Establishment of the National Fluid Control Engineering Research Society and Its First Annual Conference, which was officially held in Jiujiang City of Jiangxi Province on 19-27 Jul 82. Participants included 258 delegates representing 187 organizations of all provinces and cities of the country. A total of 58 papers were received and all were delivered before the conference or a group of delegates. The papers touched upon basic theories, research and application of components, analysis of dynamic characteristic of systems, test and measurement, numerical simulation, computer control, and optimization designing. During the conference, the 2 reference textbooks of Basic Control Theory and Designing and Analysis of Hydraulic Servo Systems were discussed and some valuable opinions proposed. Finally, the constitution of the society and an outline of it were passed and members of the society's board of directors elected. The work of preparing the next annual conference was also properly arranged.

6168
CSO: 4009/54

AUTHOR: LIU Zutang [0491 4371 0781]

ORG: None

TITLE: "Successful Fabrication of HWL-1 Constant Temperature Heater Current Meter for Turbulent Research"

SOURCE: Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese Vol 4 No 4, Nov 82 p 77

ABSTRACT: East China College of Water Conservancy and Nanjing Electron Tube Plant have successfully made the HWL-1 constant temperature hot-wire current meter through joint research. Its major functions are to measure the average current velocity of one-dimensional and two-dimensional gaseous space point, momentary current speed, pulse current speed, speed distribution of boundary layer, degree of turbulence, Reynolds stress, etc. It may also be used for simple frequency spectrum analysis. The prototype has been tried by Nanjing College of Aviation, University of National Defense Science and Technology, the 708 Institute of Ministry of Machines No 6, Research Institute of Water Conservancy and Hydroelectricity Ministry of Hydroelectricity, etc. where the test results were compared with those of the System 7224 made in Japan, DISA made in Denmark, and the TSI made in the USA and found to be basically identical. Its major technical indices were found to correspond with the Japanese System 7224. Following its most recent certification by Jiangsu Provincial Bureau of Higher Education, Nanjing Electron Tube Plant has been assigned to produce it.

AUTHOR: None

ORG: None

TITLE: "High Speed Photography of the Penetration Process"

SOURCE: Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese Vol 4 No 4, Nov 82 p 77

ABSTRACT: During its penetration mechanism research, the Office No 2 of Research Institute of Mechanics Chinese Academy of Sciences used the ZFD-50 holding type rotary lens style high speed camera to photograph the high speed collision penetration process. Clear and continuous pictures (illustrated in the paper) of the penetration process were obtained. The ZDF-50 holding type high speed camera is capable of shooting 500,000 frames per sec. The light exposure time for each frame is 0.82 μsec. The ZFD-50 high speed camera is the product of Xian Institute of Optical Machines.

6248
CSO: 4009/53

AUTHOR: ZHANG Zhixun [1728 1807 8113]

ORG: Iron and Steel Division, Ministry of Metallurgical Industry

TITLE: "Present Condition and Future Prospects of Sintering and Pellet-production Technology in China"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 10, Oct 82 pp 61-67

ABSTRACT: In these 30+ years, there have been 2 periods of great strides in the development of sintering technology in China: (1) Late 50's to early 60's: Technique of adding lime for steam preheating was successfully adopted at Anshan Steel Mill, etc. in 1959; Chungqing Steel Mill began to use ultrabasic sinter in 1963 to produce a more economic technique of blast furnace smelting of high oxide silicon ores that are difficult to dress. (2) After 1976: The production of sintered ores increased 64 percent; the consumption of solid fuel was reduced 25 percent. Compared with foreign countries, some work processes are incomplete, equipment is backward, the level of work techniques is low, and the quality of sintered products not as high. Moreover, the energy consumption is still too high and environmental protection too poor. A long list of reform measures is proposed. Pelletizing experiments, started in foreign countries in the middle 40's, began in Anshan Steel Mill in 1958. After 1968, 10+ small operations were set up. By late 1981, pellet-producing capability in China amounted to about 8 percent of the total artificial aggregate-producing capability of the country. These operations are described in some detail.

AUTHOR: None

ORG: None

TITLE: "Symposium on Metallurgical Reaction Kinetics and the 2nd Symposium on Steelmaking Theory"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 10, Oct 82 p 78

ABSTRACT: The Metallurgical Reaction Kinetics Symposium and the 2nd Symposium on Steelmaking Theory, jointly sponsored by Metallurgical Process Physics-Chemistry Committee &hdnSteelmaking Committee of China Society of Metals, was held in Chungqing, on 12-16 Apr 82. Participants included 124 official delegates of 60 units. More than 100 persons also attended as invited guests. The symposiums received 42 papers, the contents of which included kinetics of various kinds of reactions, mathematical and physical simulation, application of transmission in metallurgy, experimental methods, and comprehensive discussions. There were 6 delegates recently retruning from studies abroad. They all delivered papers and introduced foreign metallurgical research studies. Recently, metallurgical kinetics research is very active internationally. It was suggested during the meetings that the Metallurgical Process Physics-Chemistry Committee Chinese Society of Metals should establish a Metallurgical Kinetics Group.

AUTHOR: SONG Xuexiao [1345 1331 1321]

ORG: None

TITLE: "Scientific Conference on Special Metallurgy and Electrometallurgy"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 82 p 81

ABSTRACT: The 1982 Scientific Conference on Special Metallurgy and Electrometallurgy of China Society of Metals was held in Shenyang, on 25-29 Apr; more than 120 members of the group, authors of papers, and invited guests attended. The papers basically reflected the economic benefits from the reform measures adopted in China in recent years. The power consumption per ton of steel has been reduced from the 2,000 kwh of the past to 1000-1500 kwh, as low as 800 kwh in some cases. Due to the use of computer control, the smelting process is stabilized to cause the quality of the steel to be improved. Due to the development of trace elements volatilization, vacuum deoxidization and denitrification, the product quality of vacuum metallurgy has been improved. The delegates believed that the economic property of the electroslag equipment is poor and manufacturing department should prepare for replacement. Research on work procedure should still emphasize quality, with economic benefits as an added goal only. Studies on the application of basic theories should be strengthened to improve cooperation between research institutes and factories so that theoretical research may serve production still better.

AUTHOR: None

ORG: None

TITLE: "1983 Plan of Ironmaking Society Activities"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 82 p 82

ABSTRACT: The Ironmaking Committee of China Society of Metals has plans of calling the following conferences in 1983: (1) A symposium on the reconstruction of current blast furnaces and sintering machines. It will be sponsored jointly by Ironmaking Committee and Metallurgical Equipment Committee, last 6 days, and attended by about 120 delegates.(2) Symposium on inspection technology and automation to discuss mainly domestic and foreign blast furnace inspection and testing techniques, and computer automatic control to investigate the possibility of using new testing instruments and computers for blast furnaces in China. It will be jointly sponsored by Ironmaking Committee and Automation Technology Committee, to last 5 days, and to be attended by about 120 delegates. (3) Symposium on Iron Smelting Physics and Chemistry to discuss mainly problems of iron making and aggregate producing theory. It will last 5 days and be attended by about 50 persons.

6248
CSO: 4009/50

AUTHOR: LI Feng [7812 7364]

ORG: None

TITLE: "First National Symposium on Color Center Laser Held in Quanzhou"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 2 No 6, Nov 82 p 516

ABSTRACT: The First National Symposium on Color Center Laser was held 5-10 Jun 82 in Quanzhou City, Fujian Province, under the auspices of Optical Materials Specialty Committee of China Society of Optics and the Department of Chemical Engineering of Quanzhou Overseas-Chinese University. Participants included 68 delegates representing 33 organizations all over the country. The contents of the 37 papers delivered included 8 specially requested papers on the formation of color center, its transformer and decay mechanism, the use of color center to produce laser and its experiments and theoretical investigations, and various possible aspects of applications of color center laser. In China, the work on solid state tunable color center laser has just begun. Judging from the reports presented this time, the work being conducted at the various organizations is more or less the same, concentrating on the F_2^- center of alkaline-earth metal fluoride LiF crystals. It was proposed that Research Institute of Structure of Matters Chinese Academy of Sciences, Changchun Research Institute of Optical Precision Machinery, Shanghai Jiaotong University, Overseas-Chinese University, Tianjin University, Jilin University, and China Academy of Metrology should organize a cooperative team to study KCl color center laser and its application in metrological standards. It was also resolved that another symposium should be called in 2 years.

AUTHOR: ZHANG Shanshan [1728 3790 3790]

ORG: None

TITLE: "Technical Exchange Symposium on Optical Aspherical Surface Processing Held in Jiading, Shanghai"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 2 No 6, Nov 82 p 530

ABSTRACT: A Technical Exchange Symposium on Optical Aspherical Surface Processing was held on 5-9 Jul 82 in Jiading, Shanghai. It was called by the Joint Committee of Optical Technology, which was organized by 6 research institutes of Chinese Academy of Sciences. The symposium was attended by 64 delegates, representing 17 organizations. Among the 29 papers received, delivery was arranged for 17, covering the following 3 general aspects: astronomical lens and aspherical surface processing technology here and abroad, new techniques of examining aspherical surface, and high precision aspherical surface cutting machines. To a certain degree, the symposium reflected the current level of technology of this field. The progress made by the participating organizations in processing as well as inspecting aspherical optical suface was apparent. It remains highly urgent to summarize the research studies on these subjects to meet the needs of scientific and technological development, however.

AUTHOR: YI Min [0044 3046]

ORG: None

TITLE: "First National Symposium on Basic Optics and A Meeting of the Basic Optics Specialty Committee Held in Beidaihe"

SOURCE: Shanghai GUANGXUE XUEBAO [ACTA OPTICS SINICA] in Chinese Vol 2 No 6, Nov 82 pp 546, 550

ABSTRACT: The First National Symposium on Basic Optics, sponsored by China Society of Optics was held on 24-28 Jun 82 in Beidaihe of Hebei Province. Participants included 131 delegates representing 54 organizations of 18 provinces and cities. The delegates were divided into groups to listen to the 76 papers, selected from more than 180 received. These papers may be classified in 6 categories: classic optics, laser spectroscopy, laser physics, intense light and nonlinear optical effect, optical information processing and holography, and atmosphere and waveguide optics. Enthusiastic discussions proceeded on the 4 special subjects of optical information processing, laser spectroscopy and laser physics, intense light and nonlinear optics, and classic optics. For many years, basic research is the weaker aspect of the field of optics in China. Judging from the papers delivered this time, although a great distance remains between the current level of this field in China and the advanced level of the world, very great progresses have been made. A very good beginning has obviously been established.

6168
CSO: 4009/58

AUTHOR: LI Zi [2621 6926]

ORG: Shanghai Research Institute of Power Generating Equipment

TITLE: "Conference on the Quality of Power Generating, Power Transmission and Transformer Equipment Held in Beijing"

SOURCE: Shanghai DONGLI GONGCHENG [POWER ENGINEERING] in Chinese No 6, 15 Dec 82 p 19

ABSTRACT: The Conference on the Quality of Power Generating, Power Transmission and Transformer Equipment, jointly called by Ministry of Machine Industry and Ministry of Water Conservancy and Electric Power, was held in Beijing on 30 Jul 82. More than 300 delegates, representing 67 subordinate units of Ministry of Machine Industry and the 56 subordinate units of Ministry of Water Conservancy and Electric Power participated. Using the serious accidents of thermal and hydroelectric power plants in recent years as typical examples, the purpose of this conference is to analyse the causes, absorb the lessons, improve the understanding, and formulate regulations to perfect the quality of products so as to raise the quality of power generating and transmission and transformer equipment. The conference proceeded in 4 segments. Items for perfecting thermal power equipment were nearly half completed. All efforts are being exerted to bring some effective results in 3-5 years.

AUTHOR: YANG Wengu [2799 2429 7711]

ORG: Shanghai Research Institute of Power Generating Equipment

TITLE: "Conference on the Strength of Pressure-bearing Vessel of Boilers Held in Beijing"

SOURCE: Shanghai DONGLI GONGCHENG [POWER ENGINEERING] in Chinese No 6, 15 Dec 82 p 74

ABSTRACT: A Conference on the Strength of Pressure-bearing Vessel of Boilers, sponsored by the Society of Motive Power Engineering, was held in Beijing on 7-11 Oct. Participants included 55 delegates of 30 organizations, such as Ministry of Labor Affairs, Qinghua University, Designing Academy No 2 of Ministry of Nuclear Industry, Shanghai Research Institute of Power Generating Equipment of Ministry of Machine Industry, etc. The conference was chaired by HONG Bangjun [3163 6721 0193] Director of Beijing Boiler Plant and a member of the board of the Society of Motive Power Engineering. The conference received 28 papers. Discussions proceeded in 2 groups of power station boilers and industrial boilers. Thermal stress field electrical simulation experiment, computation of temperature differential stress, and determination of temperature field, etc. were among the problems enthusiastically discussed.

6168
CSO: 4009/66

AUTHOR: CAI Hanwen [5591 3352 2429]

ORG: None

TITLE: "A Method for Calculating the Kill Probability of Antiaircraft Weapon With Touch Initiation"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 4, Nov 82 pp 1-8

ABSTRACT: Antiaircraft weapons with touch initiation use, mostly, small caliber bullets and can destroy the target only if there is a direct hit. The kill action is obviously different from those antiaircraft weapons using large caliber, non-contact explosion type bullets. The existing kill probability calculation methods [2 papers of USSR origin are given as reference for these available methods] are; therefore, not applicable. This paper introduces an engineering calculation method, with which the position of the explosion point is determined on the basis of the external shape of the target and the manner of the encounter. The kill indices are established by the kill effect in the vicinity of the explosion point. Processes and equations needed for carrying out this type of calculation are provided.
This paper was received for publication on 22 Oct 80.

AUTHOR: WANG Shufen [3769 3219 5358]

ORG: None

TITLE: "A Two-Wave-Band Antireflection Coating"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 4, Nov 82 pp 9-15

ABSTRACT: Presently, a transparency-enhancing thin-film is being commonly used to form an antireflection coating for optical instruments to raise their light penetrating property. With the development of science and technology, the number of composite optical instrument is rising and hence there is a growing need for an antireflection coating capable of enhancing the penetration of two or more wave bands. For example, in order to reduce the weight, the size of the YAG laser device has been made smaller to cause the visible spectrum aiming system and the 1.06μ wavelength laser emission and reception system to be combined so that an antireflection coating effective for both visible light and 1.06μ laser becomes an urgent need. This paper reports a procedure of using effective boundary theory analysis and designing to select the initial thin-film system before using the film for automatic designing program adjustment to produce, very conveniently, the optimal film system for the coating.
This paper was received for publication on 23 Feb 81.

6248
CSO: 4009/46

END